AD-A036 388 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 17/7
NAVAID SUPPORT OF HIGH-ALTITUDE AREA NAVIGATION ROUTES.(U)
FEB 77 A G HALVERSON, F B WOODSON

UNCLASSIFIED FAA-NA-76-49 FAA/RD-76-210 NL

1 OF 2
AD A036388

Report No. FAA-RD-76-210

NAVAID SUPPORT OF HIGH-ALTITUDE AREA NAVIGATION ROUTES

Arthur G. Halverson

Floyd B. Woodson

FEBRUARY 1977

INTERIM REPORT

Document is available to the public through the
National Technical Information Service
Springfield, Virginia 22151

Prepared for

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20590

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FAA-RD-76-210		

4. Title and Subtitle	5. Report Date
NAVAID SUPPORT OF HIGH-ALTITUDE AREA NAVIGATION ROUTES	Feb[redacted]77
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Arthur G. Halverson and Floyd B. Woodson	FAA-NA-76-49
9. Performing Organization Name and Address Federal Aviation Administration National Aviation Facilities Experimental Center Atlantic City, New Jersey 08405	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. 044-326-010
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Systems Research and Development Service Washington, D.C. 20590	13. Type of Report and Period Covered Interim report Jun[redacted]974 — Oct[redacted]1976
	14. Sponsoring Agency Code

15. Supplementary Notes

121p.

16. Abstract

A study was conducted at the National Aviation Facilities Experimental Center (NAFEC) in order to determine the capability of the present system of navigational aids (NAVAID's) to support an area navigation (RNAV) route structure. Coverage contours for each NAVAID were derived through application of radio line-of-sight (LOS) angles from the antenna to the surrounding terrain. A hypothetical high-altitude RNAV structure was tested against the coverage contours of the NAVAID's presently used in the airspace at 18,000 feet and above. Each parent route and its related parallel offsets were checked for areas of excessive route width as well as for areas of noncoverage at a flight altitude of 18,000 feet. Based on these results, it is concluded that the present NAVAID system will support a high-altitude RNAV route structure with only minor problems, principally in connection with route widths. But the extent of this problem depends upon air traffic control requirements and the assumed cross-course navigational errors. With definite information regarding these factors, the methodology developed at NAFEC can be effectively used to isolate and identify specific NAVAID coverage problems.

17. Key Words	18. Distribution Statement
Area Navigation NAVAID's Coverage Navigational Errors Topographic Data	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Uncassified	Unclassified	122	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

240 550

METRIC CONVERSION FACTORS

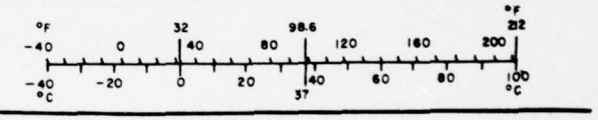
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

The authors wish to express appreciation to Messrs. Stanley Safferman and Franklin Atwell of the Electromagnetic Compatibility Analysis Center, Annapolis, Maryland, for their cooperation and enthusiastic support in providing the terrain data used to derive the NAVAID coverage information presented in this report. Appreciation is also extended to Messrs. Shigetaka Kikkawa and Denton Harold, Jr. of Computer Sciences Corporation and to Messrs. Richard Soper and Thomas Choyce of the Analysis Branch, ANA-220, of the National Aviation Facilities Experimental Center, Atlantic City, New Jersey, for the development of computer software used in the study and for the critical review of the resulting data.

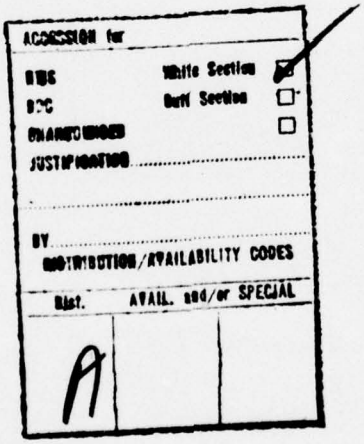


TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (continued)

INTRODUCTION

PURPOSE.

One of the questions concerning the application of area navigation (RNAV) in the National Airspace System (NAS) is the adequacy of the present system of navigational aids (NAVAID's) to support an efficient RNAV route structure. In this context, NAVAID support of a route structure involves signal coverage at specified altitudes, a route width to accommodate cross-course navigational errors, and the capability to utilize the RNAV offset function. To derive definitive answers to these questions requires that a proposed RNAV structure be tested against the known capabilities of the present NAVAID system, applying, as appropriate, valid assumptions and/or criteria relative to navigational errors, route structure requirements, RNAV avionics capabilities and other factors. At this point, however, such definition is not feasible, since RNAV route structure development has not reached the point where a sufficiently extensive and optimum structure exists, nor have the capabilities of the present NAVAID's been adequately determined. Accordingly, an approach has been taken which will (a) provide coarse-grained answers for planning purposes, and (b) produce a method by which more definitive information can be derived once such an implementation structure has been developed.

This approach involves the application of digitized topographic data to determine NAVAID coverage estimates and then to test a hypothetical RNAV route structure against the coverage contours so derived. The approach is centered around the use of large-scale data processing with the provision for manual review and evaluation.

The purpose of this interim report, therefore, is to describe the method developed for this purpose and to present some early results from its application on a hypothetical high-altitude RNAV route structure (reference 1).

BACKGROUND.

As described in reference 1, the National Aviation Facilities Experimental Center (NAFEC) has been involved in the design of RNAV structures for the purpose of route structure concept development and system payoff analyses. In this work, one of the ground rules was that NAVAID requirements would be determined following route structure development in order that problem areas could be identified and appropriate trade-offs defined. Therefore, in parallel with the route structure design work, NAFEC was also engaged in developing a system of computer programs and other methodology which could be used to derive these requirements.

Since only a minimal amount of flight test data was available, it was decided to use the topographic data base being established in digital form at the Electromagnetic Compatibility Analyses Center (ECAC) Annapolis, Maryland. For several years, ECAC has been receiving digitized topographic data from the Defense Mapping Agency (DMA), which is used by ECAC in a wide range of projects

for the Department of Defense and the Federal Aviation Administration (FAA). At the time the RNAV route structure study was initiated, ECAC had received topographic data on most of the conterminous United States (U.S.), and it was estimated that the data base would be completed during the time that the NAFEC study was in progress. A contract with ECAC was established wherein ECAC would provide NAFEC with the topographic data surrounding each NAVAID in a form amenable for computer-based coverage determination. A system of computer programs was developed by NAFEC (a) to derive NAVAID coverage at any selected altitude, and (b) to test any given route structure against the coverage contours to determine coverage gaps, excessive cross-course errors, and other problems.

It is recognized that precise data, relative to the coverage provided by a navigational facility, can only be obtained by flight checking the facility at specified altitudes. It is not intended, therefore, that the use of topographic data to determine NAVAID coverage will obviate the need for standard flight checking operations associated with airway/route establishment and approval. These data can be useful in planning for RNAV implementation, however. In particular, by using the terrain surrounding a NAVAID to estimate coverage at any selected altitude, problem areas can be identified and more accurate data can then be derived through flight checking. It should be noted at this point that planning for RNAV implementation over the conterminous U.S. requires 360°-coverage data at several altitudes for as many as 1,100 facilities. It is obvious that acquisition of sufficient flight check data for this purpose would be prohibitive in cost and time. It is with this in mind that NAFEC developed a method to utilize topographic data to derive coarse-grained answers to the NAVAID coverage question.

In this report, a general description of the method of approach is given together with a description of the data base that has been established at NAFEC. In addition, the report contains a brief discussion on the results derived when the RNAV route structure presented in reference 1 was tested against the NAVAID coverage contours. More detailed description of the computer software, data validation procedures, and other information are available from the project files at NAFEC.

DATA BASE PREPARATION AND DESCRIPTION

OVERVIEW.

In general, the preparation of topographic data to determine NAVAID coverage involved several stages of manual and computer-based processing functions. The functions were performed at DMA, ECAC, and NAFEC and are summarized as follows:

1. DMA.

a. Converts topographic contour data to digital form on a rectangular grid.

b. Processes digitized contour data to produce a matrix of topographic data points spaced at 3-second intervals. Data at grid intersections are derived by interpolation between consecutive contour values.

c. Selects data points at 30-second intervals for input to the ECAC data base. This processing is accomplished over an area of 1° latitude by 1° longitude.

2. ECAC.

a. Merges data blocks from DMA to form a topographic data base (i.e., a topographic mosaic).

b. Performs manual and computer-based data validation to detect gross errors such as problems at the seams between adjacent blocks, etc.

c. Computes angles formed at the NAVAID antenna between the horizontal and terrain elevation at each 1/2-mile interval out to the radio line-of-sight (LOS). Elevation angles are computed for each 1° radial of the NAVAID for coverage processing by NAFEC.

3. NAFEC.

a. Converts ECAC data for machine compatibility.

b. Performs manual and computer-based data validation to detect errors in site location and site elevation and to uncover other problems in the data that are observable.

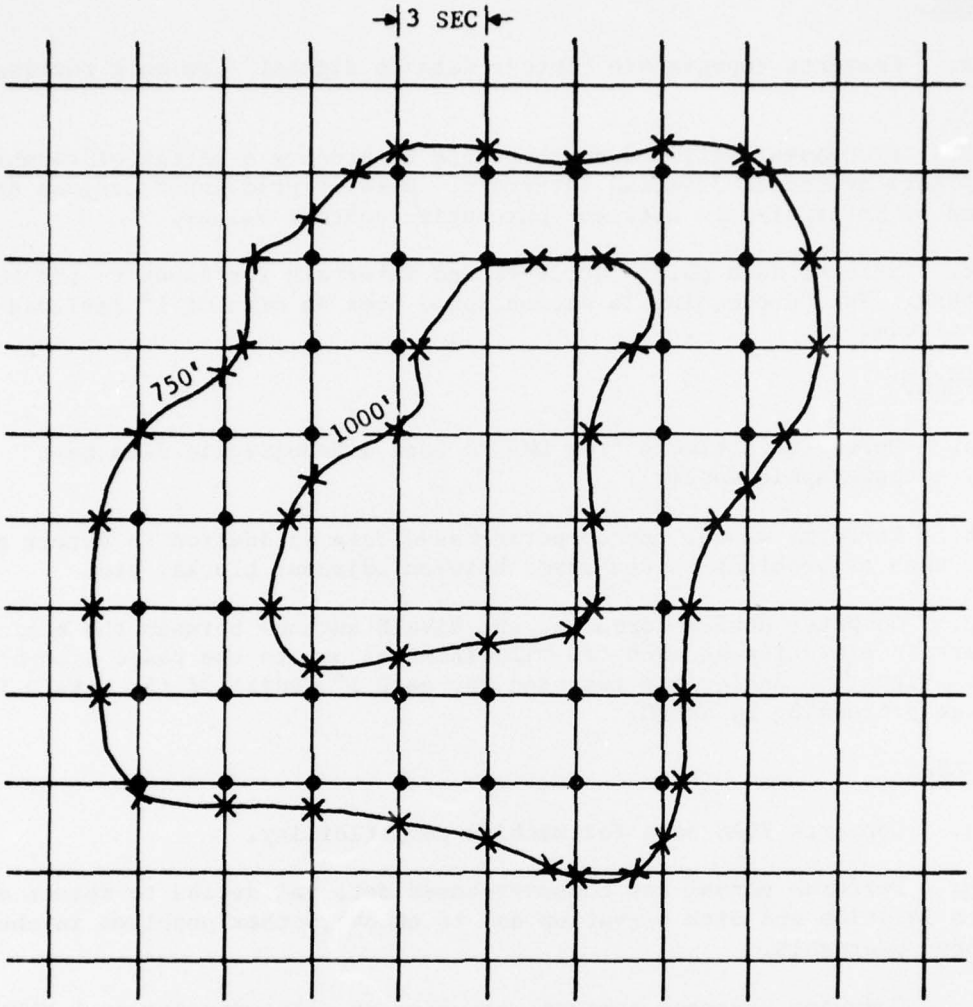
c. Computes coverage contours at selected altitudes for each NAVAID for which terrain data has been provided by ECAC.

d. Plots contours and compares these data with flight-check data where available.

e. Matches NAVAID coverage contours against RNAV route structures to determine coverage gaps, excessive cross-course errors, and other problems.

DETAILS OF THE APPROACH.

As can be seen from the above summary, the process starts at DMA where a contour digitizing technique has been developed. The technique involves recording the points where a specific contour line crosses the orthogonal lines of a rectangular grid (figure 1). After all contours for a particular area have been recorded, the data for the grid intersection points are



(A) POINTS MARKED "X" ARE RECORDED BY CONTOUR FOLLOWER

(B) POINTS MARKED "●" ARE COMPUTED BY INTERPOLATION BETWEEN CONTOUR LINES.

FIGURE 1. SCHEMATIC OF CONTOUR DIGITIZING

computed through interpolation between the closest contour values. The data are then organized into 1°x1° blocks. For this project the contour lines were derived from a topographic map with a scale of 1:250,000 (approximately 4 statute miles per inch). Because of the available computer storage, ECAC requested that DMA select every tenth data point, which produces a 30-second (approximately 1/2 mile) spacing of the terrain data. In addition to the reduced storage requirements, it was felt that the accuracy of 30-second spacing was consistent with the precision inherent in the use of the 1:250,000 scale map. Such granularity tends to reduce terrain heights (due to interpolation) and frequently terrain peaks are missed. Therefore, as will be shown later in the report, finer grain granularity is needed for NAVAID coverage determination.

A good deal of manual effort is involved in the DMA process; therefore, validation is required to detect human errors. Some of these errors cause gross aberrations in the data, which can be detected through the use of computer processing and manual analysis. ECAC developed a system of computer software which provides a cathode ray tube (CRT) display, CALCOMP plots, tabular data, and other information which facilitate visual observation of the digitized terrain data. Although blunders, such as data entry errors, can normally be detected in this manner, other more subtle errors may not be discovered. It is for this reason that NAFEC also established a method for data validation, discussed later in the report. In any event, after validation, ECAC merges the data blocks received from DMA to form a mosaic of the terrain data. This is referred to as the ECAC Topographic Data File (T-File). At present, the T-File covers the conterminous U.S., Hawaii, and part of Alaska.

In addition to the T-File, ECAC has developed an equipment-oriented file generated from data furnished by various government sources, including FAA. This file is referred to as the Environment Data Base (E-File). The E-File data furnished to NAFEC contain the following information for each NAVAID as appropriate:

1. Organization Unit Designation,
2. City,
3. State,
4. Latitude/Longitude,
5. Radar/Communication Indicator,
6. Equipment Nomenclature,
7. Equipment Function Code,
8. Frequency in Megahertz (MHz),
9. Horizontal Motion Rate--revolutions per minute (r/min) or scans per minute,
10. Site Elevation Above Sea Level--feet,
11. Height of Antenna Above Site--feet,
12. Pulse width--microseconds (μs),
13. Record identity (ID),
14. Linkage ID,
15. Trigger Rate--pulses per second,
16. Pulses per Trigger, and
17. Equipment Quantity.

For NAFEC, ECAC developed terrain profiles around selected NAVAID's (VOR's VORTAC's, TACAN's) and radar facilities. These terrain profiles are described in terms of takeoff angles (γ) formed at the antenna between the horizontal and the terrain elevations (figure 2). Angles are computed at 1/2-mile intervals out to a maximum distance of 100 miles. The line-of-sight (LOS) point is determined by finding the largest angle along the terrain profile, and all data past the LOS point are discarded. Terrain profiles are generated for each 1° radial around the facility.

The takeoff angles along the terrain profile are computed from the following equation:

$$\gamma = \text{Arctan}\left[\frac{(E-C) - (S+H)}{D}\right]$$

where:

E = terrain elevation
S = site elevation
H = antenna height above the site
D = distance to terrain elevation
C = correction for refractivity and earth curvature, and

$$C = \frac{D^2}{2\ ka}$$

where:

a = earth radius
k = 4/3 (effective earth radius factor)

Originally, ECAC used the site elevation contained in their E-File data; however, it was later found that fewer problems would arise if site elevation was derived from the data, itself. Also, to determine terrain elevation, ECAC originally employed a 4-point interpolation method. This was later replaced by a method which selects the highest of the four topographic grid points nearest the terrain point of interest (figure 3). These changes were made after the validation at NAFEC revealed that in several cases there was a severe mismatch with the coverage contours derived from flight checks. Since agreement was very good in most cases, it was felt by NAFEC that the cause for many of the mismatches was the interpolation method employed. A subsequent analysis by ECAC confirmed this, and therefore the "highest point" method was incorporated into the software.

NAFEC receives the data from ECAC in two forms. The terrain elevation angles are on magnetic tape, and the E-File data are on a computer printout. After keypunching the E-File data, the processing at NAFEC proceeds generally in the manner as shown in figure 4 and described below.

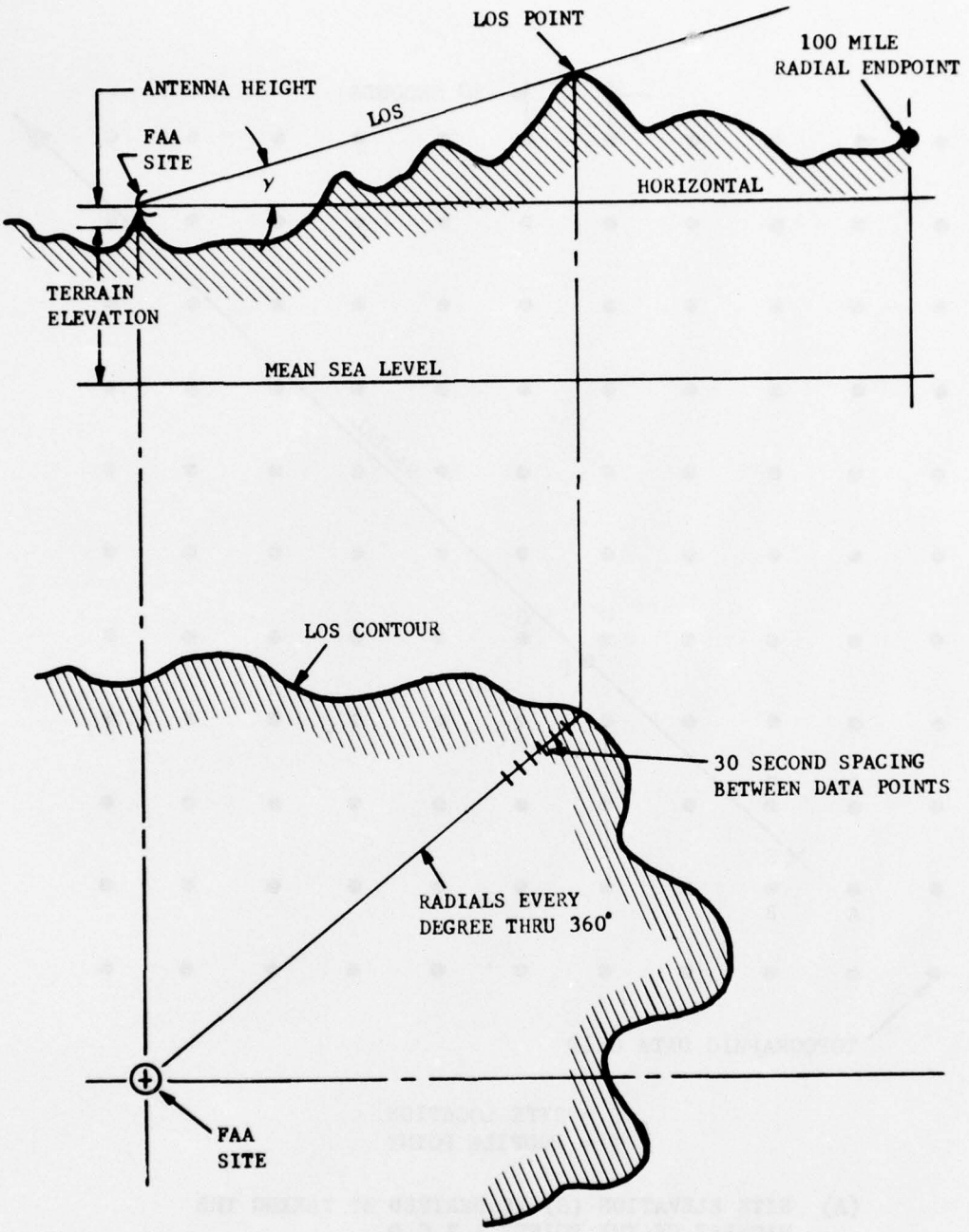
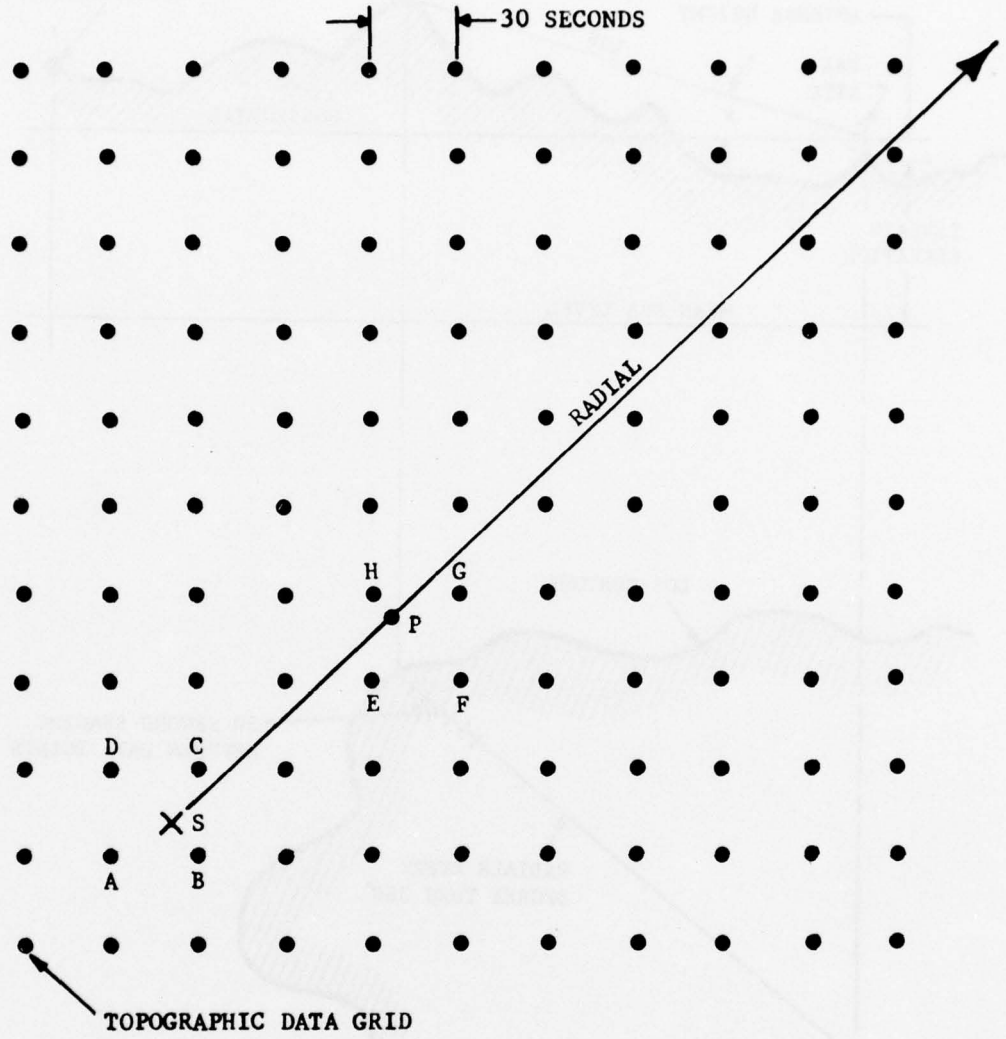


FIGURE 2. TERRAIN PROFILES



S = SITE LOCATION
P = PROFILE POINT

(A) SITE ELEVATION (S) IS DERIVED BY TAKING THE HIGHEST OF THE POINTS A,B,C,D.

(B) TERRAIN ELEVATION (P) IS DERIVED BY TAKING THE HIGHEST OF THE POINTS E,F,G,H. (THIS REPLACES THE ORIGINAL, 4-POINT INTERPOLATION METHOD.)

FIGURE 3. SCHEMATIC OF TERRAIN ELEVATION COMPUTATION

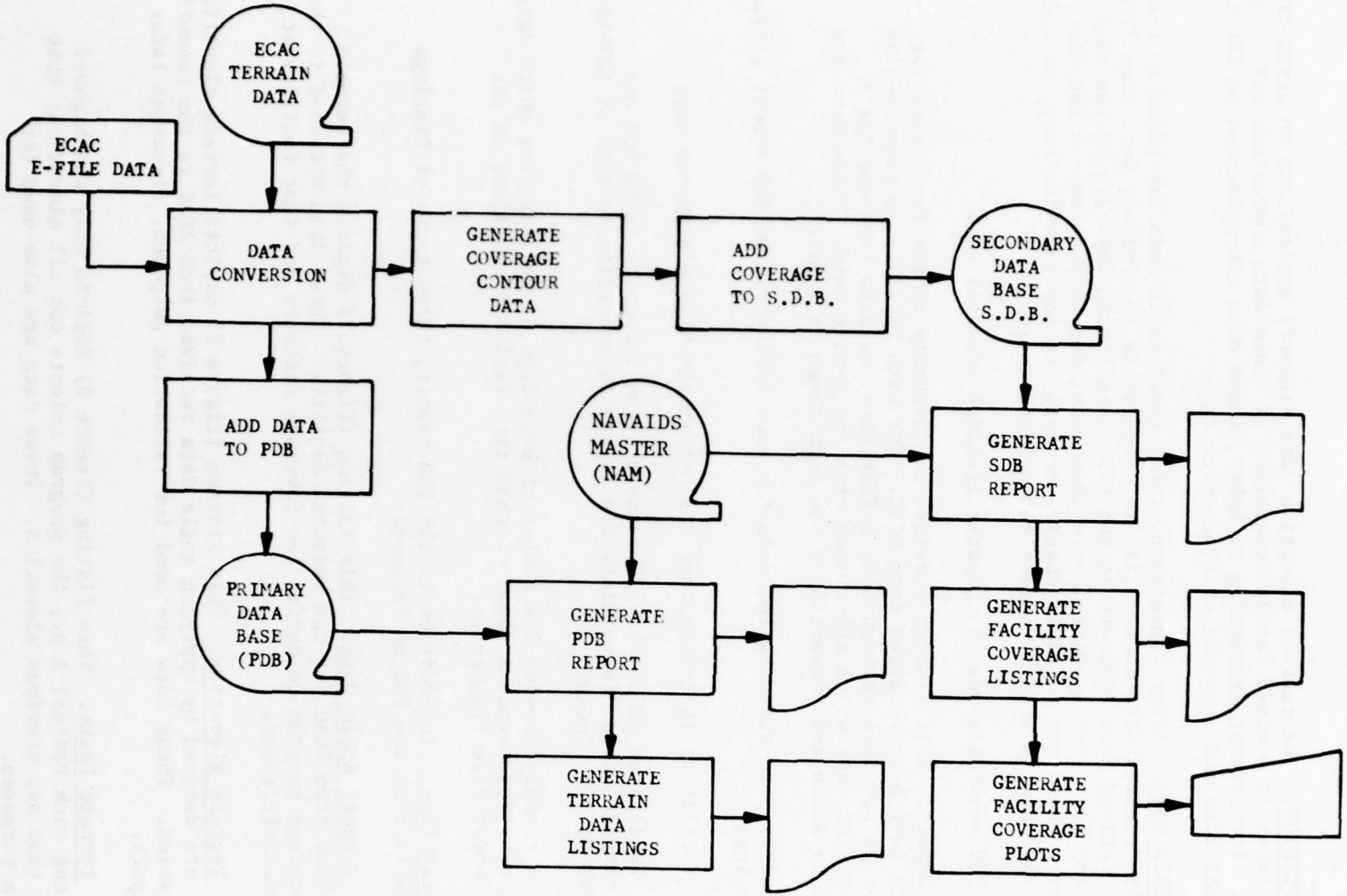


FIGURE 4. TERRAIN DATA PROCESSING AT NAFEC

DATA CONVERSION. The terrain elevation data (takeoff angles) are on seven-track magnetic tapes in a mixed format consisting of field data characters and binary integers. For further processing at NAFEC, these data are converted to EBCDIC, hexadecimal form and recorded on nine-track tape.

PRIMARY DATA BASE. After conversion, the takeoff angle data are added to the previously received data in the file referred to as the Primary Data Base (PDB). All data received from ECAC are in the PDB, even though data around the same facility may have been submitted more than once, due to problems in the earlier data. Where there are multiple entries of data for the same facility, an indicator in the data is used to select the desired entry.

From the PDB several types of computer listings are available.

PDB Report. This listing provides an inventory of the facilities for which data have been received from ECAC. For each facility, a side-by-side comparison is provided between ECAC E-File data and data from the FAA's NAVAID's master tape which are common with the E-File data. These data are organized by state and presented in the form shown in figure 5.

In addition to the detailed data for each facility, the PDB report provides the following:

a. Facilities in E-File that are not on the NAVAID's master tape.

b. Facilities on the NAVAID's master tape for which NAFEC has not received terrain data. These lists are separated according to type of NAVAID (i.e., VORTAC, VOR, TACAN).

c. A summary showing the number of each type of facility for which data have been received versus a count of that type facility contained in the NAVAID's master file (figure 6).

PDB Listings. In addition to the PDB report, three types of listings are available from the PDB as follows:

Takeoff Angle Data. This listing (figure 7) depicts the terrain data received from ECAC for the selected facility. These data are used in the NAVAID coverage program to derive the coverage contours for that facility at the selected altitudes.

Terrain Elevation. This listing (figure 8) depicts terrain elevation data that are derived by applying angle data received from ECAC to the takeoff angle equation. These data are used for validation purposes, discussed later in the report.

Terrain Peaks. This listing (figure 9) depicts only the highest points along each radial; i.e., the program selects out all elevations that are lower than any previous elevation. These data are also used for validation purposes.

NAVAID MASTER TAPE									ECAC DATA						
ID	TYPE/CLASS	LOCATION		ELV	MAG VAR	STS	I	ECAC ID	TYPE/CLASS/RC	LOCATION		ELV	ANT	TAPE	OTHER
GBN	C H	325726	1124028	790	-1400	AZ	I	E1035488	C/H/	325722	1124025	781	34	-1	
GCN	V L	358737	1120843	6670	-1500	AZ	I								
IGM	V L	351537	1135552	3406	-1500	AZ	I								
OLS	D L	312453	1105054	0	0	AZ	I								
PGS	C H	353729	1133237	4760	-1500	AZ	I	E1030874	C/H/	353729	1133237	4780	16	9	
PHX	C H	332552	1115317	1180	-1400	AZ	I	E1049614	C/H/	332553	1115317	1200	17	9	
LLF	T L	333209	1122306	1100	-1400	AZ	I								
PRC	C H	344209	1122846	4960	-1400	AZ	I	E1038924	C/H/	344209	1122846	5000	16	9	
SSE	C H	321609	1091545	3600	-1300	AZ	I	E1069078	C/H/	321609	1091545	3607	32	-1	
SLN	C H	342526	1090834	6840	-1400	AZ	I	E1069784	C/H/	342526	1090834	6860	16	-1	
TBC	C H	360716	1111608	5045	-1500	AZ	I	E1071774	C/H/	360717	1111608	5020	35	9	
DMA	T L	320936	1105249	2660	-1300	AZ	I								
TUS	C H	320721	1104912	2880	-1300	AZ	I	E1064364	C/H/	320721	1104912	2847	18	-1	
INW	C H	350341	1104739	4910	-1400	AZ	I	E1066544	C/H/	350342	1104740	5020	16	9	
NYL	T L	323848	1143645	183	-1400	AZ	I								
YUM	C H	324605	1143607	130	-1400	AZ	I	E1023544	C/H/	324605	1143607	130	34	-1	
BYH	T L	355722	895625	260	-500	AR	I								
BYH	V L	355702	895628	252	-500	AR	I								
ELD	C L	331521	924437	232	-700	AR	I								
DAK	V T	360234	941151	1530	-700	AR	I	E0608024	V/T/	360234	941151	5350	18	-4	
FYV	C H	361446	940716	1350	-700	AR	I	E0608394	C/H/	361447	940716	1330	18	-1	
FLP	V L	361758	922729	780	9999	AR	I	E0626684	V/L/	361759	922730	8200	18	-4	
FSM	C L	352317	941616	430	-700	AR	I	E0607714	C/L/	352318	941617	431	41	-1	
HRO	V L	361905	931247	1405	-700	AR	I	E0616184	V/L/	361906	931247	4150	18	-4	
HOT	V L	342842	930525	530	-700	AR	I	E0615354	V/L/	342843	930526	2700	16	-4	
LRF	T L	345504	922926	360	-600	AR	I								
LBB	V T	355229	903518	245	-500	AR	I	E1411254	V/T/	355230	903518	4600	16	-4	
LIT	C H	344039	921045	240	-600	AR	I	E0623694	C/H/	344039	921045	241	16	-1	
MEM	C L	333343	914256	0	0	AR	I	E0629494	C/L/	333343	914256	210	15	-1	
MEF	C L	341448	915433	205	-600	AR	I	E0629944	C/L/	341448	915434	230	44	-1	
TXK	C H	333049	940422	270	-700	AR	I	E0606194	C/H/R	333050	940423	260	33	9	
ARG	C H	360635	905714	260	-500	AR	I	E0633464	C/H/	360636	905713	275	16	-1	
ZBV	C H	254215	791740	10	0	BI	I	J1154078	C/H/	254215	791740	4	36	-1	
ZFF	D H	263319	784154	8	100	BI	I								
GT	T T	212600	710900	0	0	BI	I								
BCA	T H	322148	644118	0	0	BI	I								
KBV	V H	322147	644142	0	0	BI	I								
ZGA	D H	250140	772702	10	200	BI	I								
NG2	T L	374731	1221945	20	-1600	CA	I								
ACV	V L	405857	1240425	151	-1854	CA	I								
AVE	C H	353849	1195839	710	-1600	CA	I	F0900904	C/H/	353849	1195839	655	15	-7	

Type	Class
C-VORTAC	H-High
D-VOR/DME	L-Low
V-VOR	T-Terminal
T-TACAN	

FIGURE 5. SAMPLE OF PDB REPORT

PROCESSING SUMMARY

		ECAC	NAVAID MASTER
VORTAC			
	HIGH	256	313
	LOW	348	406
	TERM	2	8
	TOTL	646	727
VOR			
	HIGH	3	12
	LOW	105	165
	TERM	48	126
	TOTL	156	303
TACAN			
	HIGH	0	23
	LOW	2	99
	TERM	1	16
	TOTL	3	138
TOTAL		805	1168

FIGURE 6. PDB REPORT SUMMARY

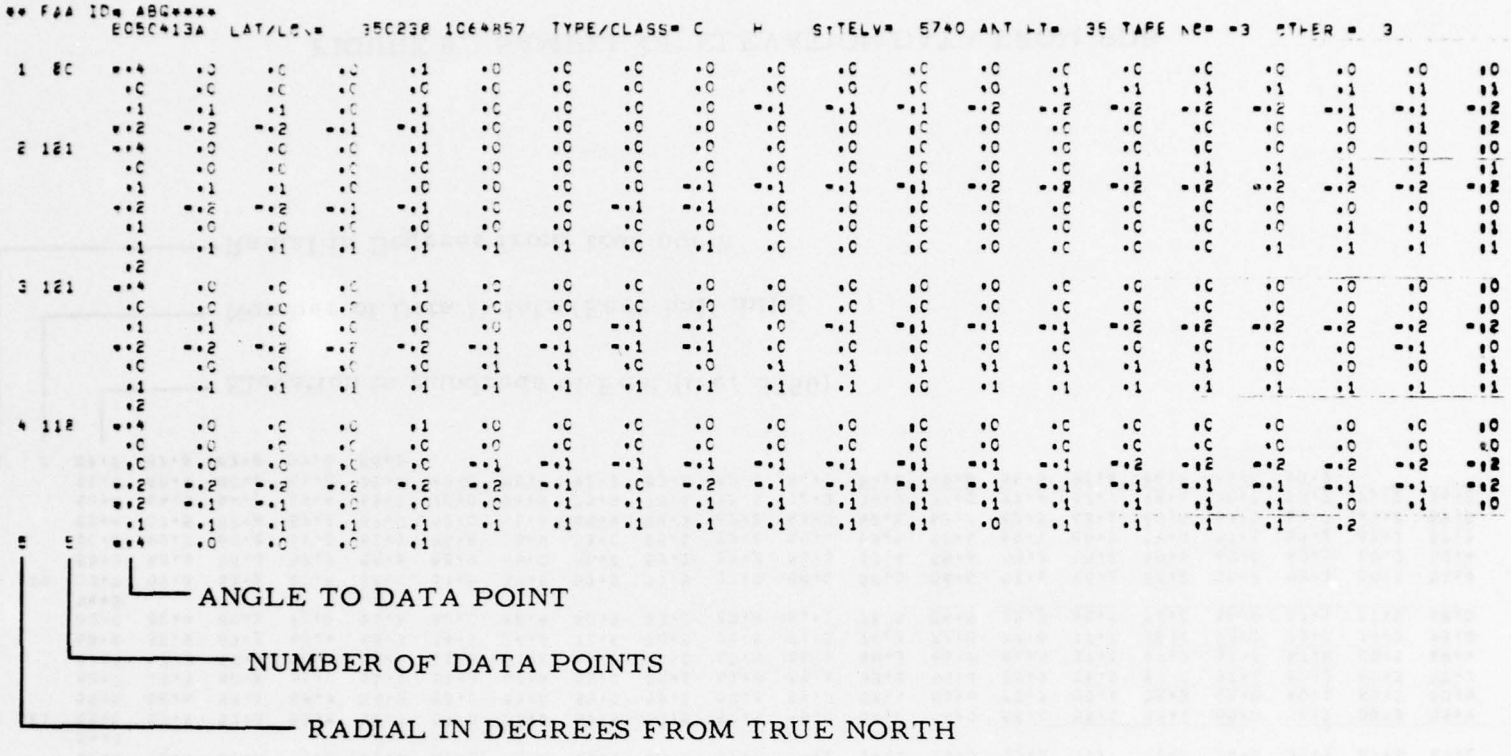
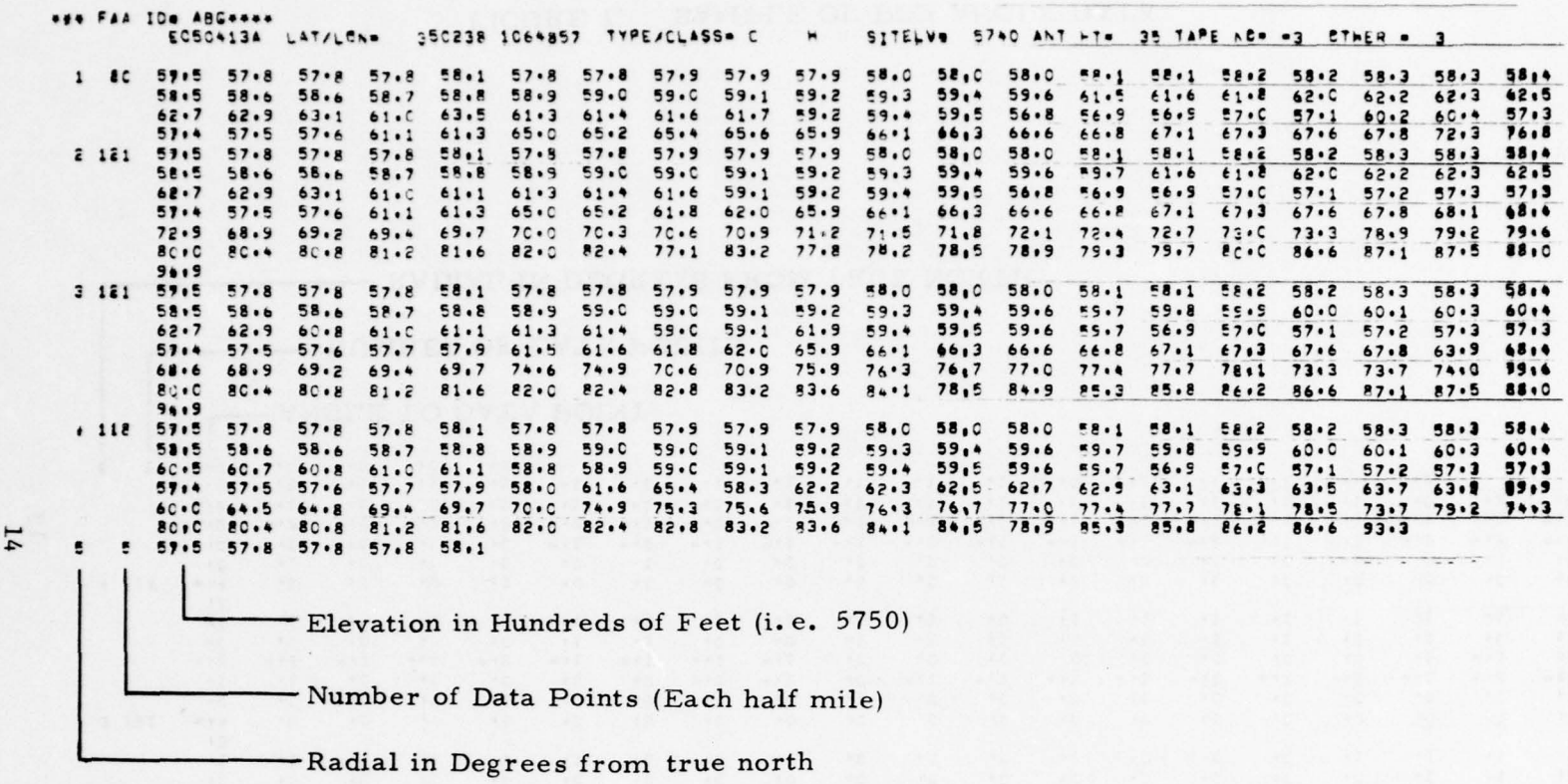


FIGURE 7. SAMPLE OF PDB ANGLE DATA



*** FAA ID= ABC**** EC504134 LAT/LON= 350238 1064857 TYPE/CLASS= C H SITELV= 5740 ANT HT= 35 TAPE NO= =3 OTHER = 3

1	80	59.5	57.8	57.8	57.8	58.1	57.8	57.8	57.9	57.9	57.9	58.0	58.0	58.0	58.1	58.1	58.2	58.2	58.3	58.3	58.4
		58.5	58.6	58.6	58.7	58.8	58.9	59.0	59.0	59.1	59.2	59.3	59.4	59.6	61.5	61.6	61.8	62.0	62.2	62.3	62.5
		62.7	62.9	63.1	61.0	63.5	61.3	61.4	61.6	61.7	59.2	59.4	59.5	56.8	56.9	56.9	57.0	57.1	60.2	60.4	57.3
		57.4	57.5	57.6	61.1	61.3	65.0	65.2	65.4	65.6	65.9	66.1	66.3	66.6	66.8	67.1	67.3	67.6	67.8	72.3	76.8
2	161	59.5	57.8	57.8	57.8	58.1	57.8	57.8	57.9	57.9	57.9	58.0	58.0	58.0	58.1	58.1	58.2	58.2	58.3	58.3	58.4
		58.5	58.6	58.6	58.7	58.8	58.9	59.0	59.0	59.1	59.2	59.3	59.4	59.6	59.7	61.6	61.8	62.0	62.2	62.3	62.5
		62.7	62.9	63.1	61.0	61.1	61.3	61.4	61.6	59.1	59.2	59.4	59.5	56.8	56.9	56.9	57.0	57.1	57.2	57.3	57.3
		57.4	57.5	57.6	61.1	61.3	65.0	65.2	61.8	62.0	65.9	66.1	66.3	66.6	66.8	67.1	67.3	67.6	67.8	68.1	68.4
		72.9	68.9	69.2	69.4	69.7	70.0	70.3	70.6	70.9	71.2	71.5	71.8	72.1	72.4	72.7	73.0	73.3	78.9	79.2	79.6
		80.0	80.4	80.8	81.2	81.6	82.0	82.4	77.1	83.2	77.8	78.2	78.5	78.9	79.3	79.7	80.0	86.6	87.1	87.5	88.0
		96.9																			
3	181	59.5	57.8	57.8	57.8	58.1	57.8	57.8	57.9	57.9	57.9	58.0	58.0	58.0	58.1	58.1	58.2	58.2	58.3	58.3	58.4
		58.5	58.6	58.6	58.7	58.8	58.9	59.0	59.0	59.1	59.2	59.3	59.4	59.6	59.7	59.8	59.9	60.0	60.1	60.3	60.4
		62.7	62.9	60.8	61.0	61.1	61.3	61.4	59.0	59.1	61.9	59.4	59.5	59.6	59.7	56.9	57.0	57.1	57.2	57.3	57.3
		57.4	57.5	57.6	57.7	57.9	61.5	61.6	61.8	62.0	65.9	66.1	66.3	66.6	66.8	67.1	67.3	67.6	67.8	63.9	68.4
		68.6	68.9	69.2	69.4	69.7	74.6	74.9	70.6	70.9	75.9	76.3	76.7	77.0	77.4	77.7	78.1	73.3	73.7	74.0	79.6
		80.0	80.4	80.8	81.2	81.6	82.0	82.4	82.8	83.2	83.6	84.1	78.5	84.9	85.3	85.8	86.2	86.6	87.1	87.5	88.0
		96.9																			
4	118	59.5	57.8	57.8	57.8	58.1	57.8	57.8	57.9	57.9	57.9	58.0	58.0	58.0	58.1	58.1	58.2	58.2	58.3	58.3	58.4
		58.5	58.6	58.6	58.7	58.8	58.9	59.0	59.0	59.1	59.2	59.3	59.4	59.6	59.7	59.8	59.9	60.0	60.1	60.3	60.4
		60.5	60.7	60.8	61.0	61.1	58.8	58.9	59.0	59.1	59.2	59.4	59.5	59.6	59.7	56.9	57.0	57.1	57.2	57.3	57.3
		57.4	57.5	57.6	57.7	57.9	58.0	61.6	65.4	58.3	62.2	62.3	62.5	62.7	62.9	63.1	63.3	63.5	63.7	63.8	69.9
		60.0	64.5	64.8	69.4	69.7	70.0	74.9	75.3	75.6	75.9	76.3	76.7	77.0	77.4	77.7	78.1	78.5	73.7	79.2	74.3
		80.0	80.4	80.8	81.2	81.6	82.0	82.4	82.8	83.2	83.6	84.1	84.5	78.9	85.3	85.8	86.2	86.6	93.3		
5	5	59.5	57.8	57.8	57.8	58.1															

Elevation in Hundreds of Feet (i.e. 5750)

Number of Data Points (Each half mile)

Radial in Degrees from true north

FIGURE 8. SAMPLE OF ELEVATION DATA FROM PDB

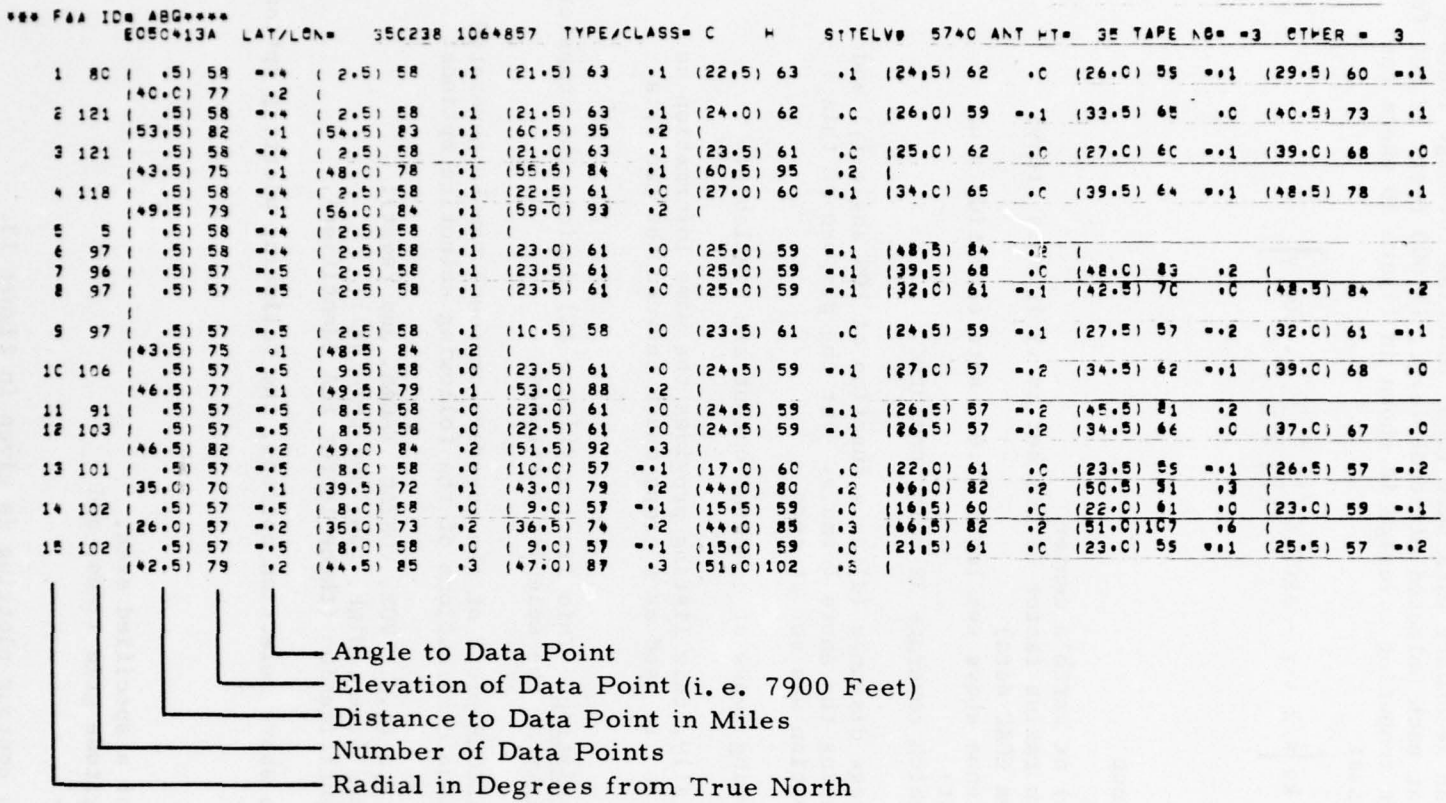


FIGURE 9. SAMPLE OF PEAK DATA FROM PDB

SECONDARY DATA BASE. The Secondary Data Base (SDB) contains coverage contour data for each facility at each selected altitude (e.g., 18,000 feet, 22,000 feet, etc.). The geometry for computing coverage is shown in figure 10 where the following equation applies:

$$d = ka\theta = ka\left[\pi/2 - \gamma - \text{ARCSIN}\left(\frac{ka + h_1}{ka + h}\right) \cdot \cos\gamma\right]$$

where:

d = coverage distance
a = earth's radius
θ = angle (radians) at earth's center
k = effective earth radius factor (k was set to .9 in this study)
γ = LOS angle (from ECAC data)
h_1 = height of antenna above sea level (i.e., site elevation plus antenna height)
h = altitude for which coverage is being computed.

Figure 11 depicts coverage distance (d) as a function of LOS angle (γ) and aircraft altitude (h) using the above formula. For the purpose of this illustration, site elevation was set at zero.

From the SDB, the following types of computer output are available:

SDB Report. Basically, this listing provides the same information as that in the PDB report and is used as a cross-check between the two data bases.

Facility Coverage Listing. This listing (figure 12) depicts the computer coverage for each facility at the selected altitudes.

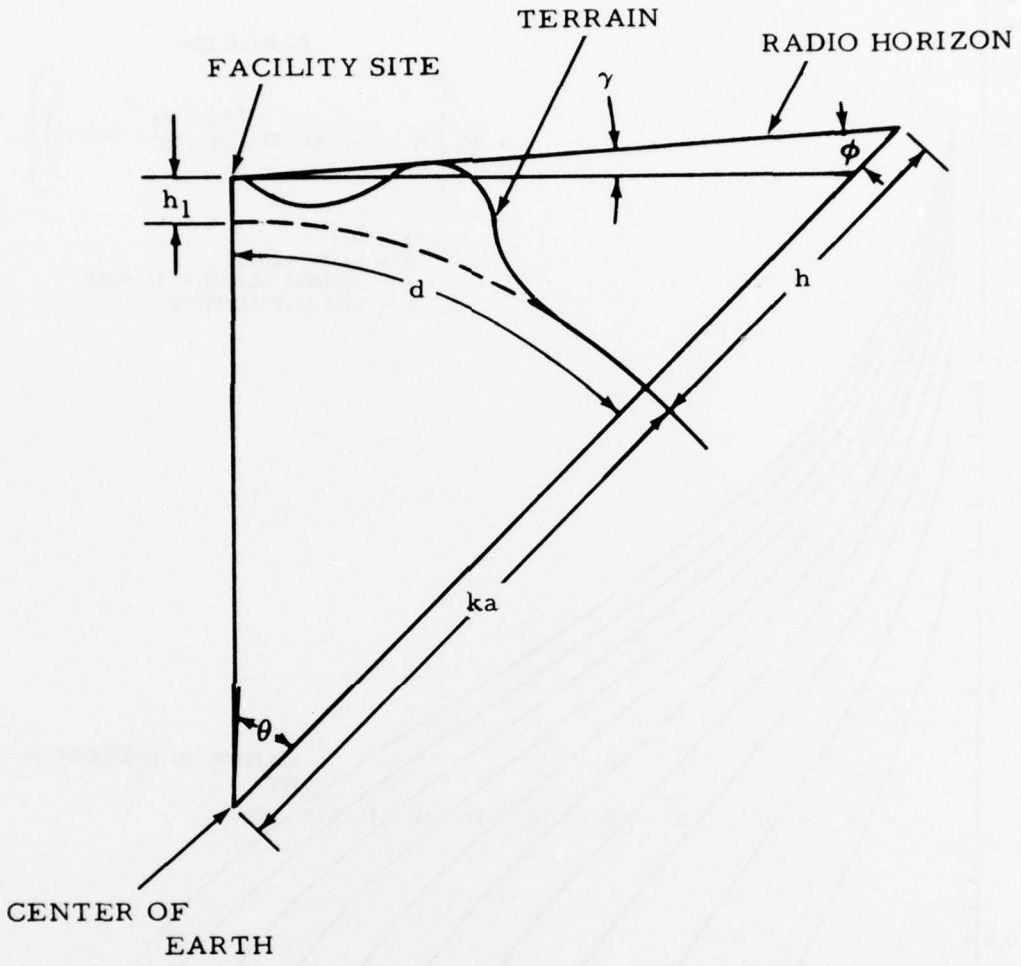
CALCOMP Plots. CALCOMP plots of the coverage contours can be generated from the SDB under various combinations of the following selection options:

a. By facility type (i.e., VOR, VORTAC, TACAN, and radar);
b. By NAVAID class (i.e., high, low, and terminal);
c. By NAVAID identification (three-letter FAA identifier).

In addition to the above selection options, the following plotting options are also available:

a. Scale,
b. Color,
c. Enlargement of a specified area,
d. Latitude/longitude grid lines, and
e. U.S. outline.

An example of this contour plotting is given in figure 13.



WHERE h_1 = ANTENNA HEIGHT
h = ALTITUDE OF TARGET
ka = EFFECTIVE EARTH RADIUS
d = DISTANCE ALONG EARTH'S SURFACE
γ = LINE-OF-SIGHT ANGLE TO TARGET

76-49-10

FIGURE 10. NAVAID's COVERAGE GEOMETRY

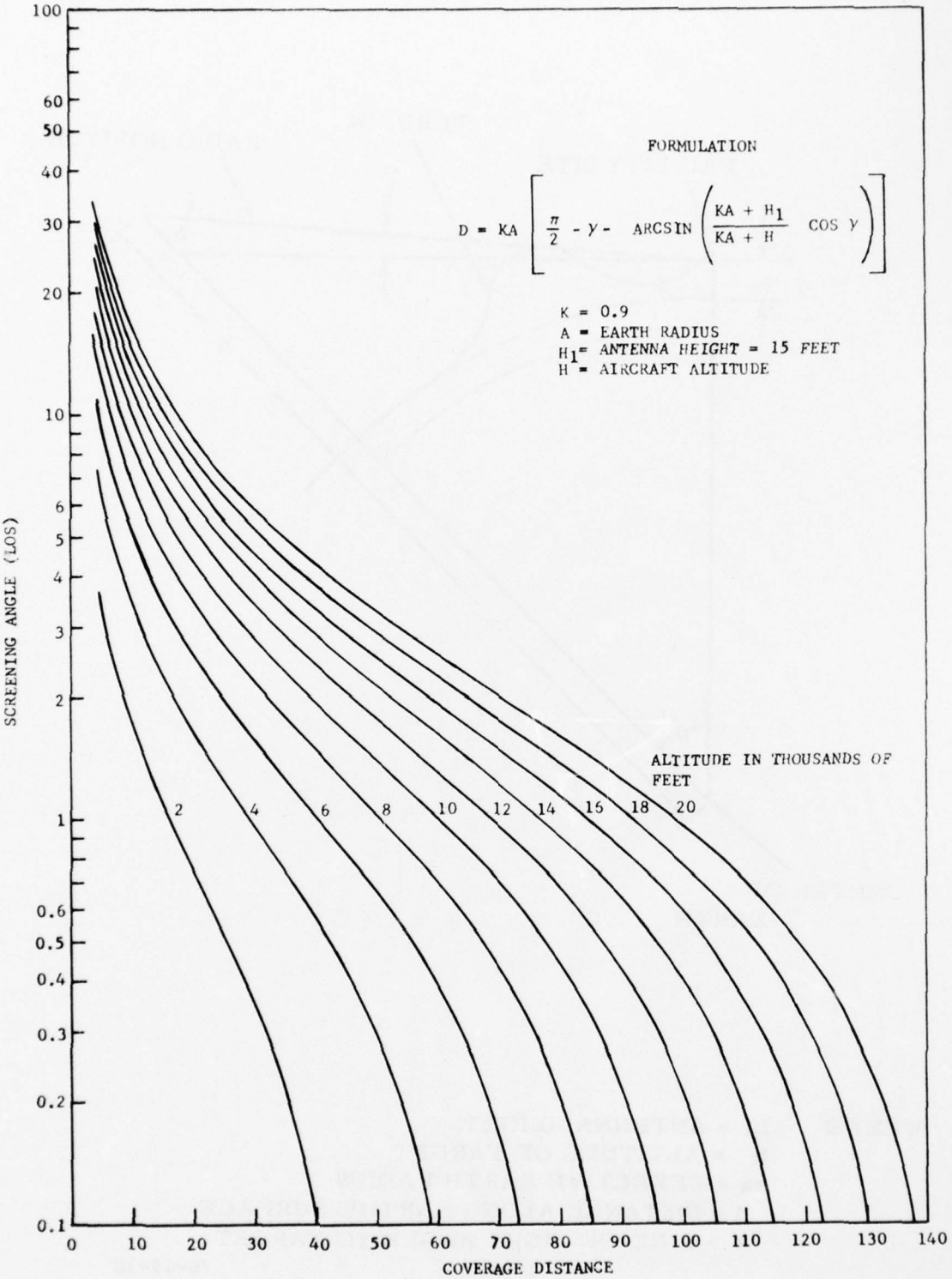


FIGURE 11. COVERAGE DISTANCE VERSUS LOS ANGLE

**** FAA ID= ABC****
BOSC413A LAT/LON= 350258 1064857 TYPE/CLASS= C H SITELV= 5740 ANT HT= 35 TAPE NO= 03 OTHER = 3

RADIAL	1	2	3	4
1	105	152	183	209
2	105	152	183	209
3	105	152	183	209
4	105	152	183	209
5	110	158	188	215
6	105	152	183	209
7	105	152	183	209
8	105	152	183	209
9	105	152	183	209
10	105	152	183	209
11	105	152	183	209
12	100	147	177	204
13	100	147	177	204
14	86	132	162	188
15	90	137	167	193
16	90	137	167	193
17	95	142	172	199
18	95	142	172	199
19	100	147	177	204
20	95	142	172	199
21	100	147	177	204
22	95	142	172	199
23	105	152	183	209
24	110	158	188	215
25	110	158	188	215
26	116	163	194	221
27	110	158	188	215
28	116	163	194	221
29	116	163	194	221
30	116	163	194	221

COL. COVERAGE AT

1. 18000 Feet
2. 30000 Feet
3. 40000 Feet
4. 50000 Feet

FIGURE 12. SAMPLE OF SDB COVERAGE DATA

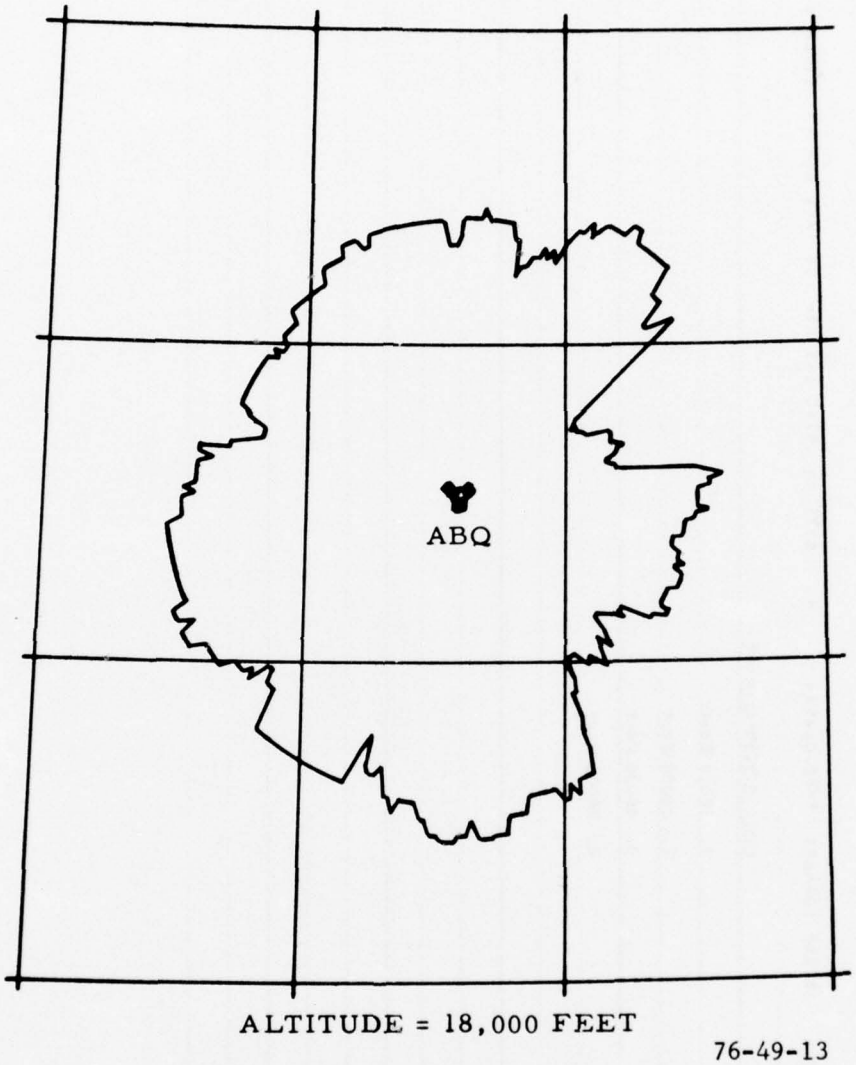


FIGURE 13. SAMPLE OF COVERAGE CONTOUR PLOT

DATA BASE VALIDATION

From the previous discussion, it can be seen that the establishment of a reliable data base for use in NAVAID coverage determination requires careful validation at various steps in the process. An overview of the validation conducted at NAFEC is shown in figure 14. From this block diagram, it can be seen that the validation process is involved in three principal areas; namely, (1) environmental data (i.e., location, site elevation, etc.), (2) completeness, and (3) coverage contours. It should also be noted that the analysis and final resolution of problem areas are performed manually. This results from the fact that, in many cases, there are several sources for the data and, historically, errors have been found in data from each of these sources. Therefore, only by cross-checking the data from the various sources is one assured of selecting the correct value or other item of data.

ENVIRONMENTAL (E-FILE) DATA.

The contents of this file were listed previously; however, of primary importance for NAVAID coverage purposes are location, site elevation, and facility class. Since these data are also on the NAVAID's master tape (NAM), a program (NAVCHK) was developed to facilitate this validation. When the program detects differences in location and site elevation that are greater than specified values (parameters), the data are flagged for manual analysis. Figure 15 is an example of the NAVCHK output. When the word "AGREES" does not appear, there will be a flag adjacent to the site elevation or adjacent to the location, or both. An asterisk adjacent to either latitude or longitude indicates a 3-second difference; a single asterisk adjacent to site elevation indicates a 350-foot difference; and a double asterisk by site elevation indicates a 100-foot difference. More than one line of data for the same facility results from the fact that ECAC resubmitted terrain data for that facility. The symbol ">" flags multiple entries, and the tape numbers identify the ECAC tape from which the data were derived (1 through 7, 9, and A through D). Note the TACAN facility, DLF, where the latitude differs by 5 seconds and the longitude by 9 seconds, and the station, DNY (tape 4), where the latitude differs by 38 seconds. These differences were resolved by examining aeronautical maps, various flight publications, and other sources where agreement in the location could be found.

In addition to location, site elevation is highly critical in the use of topographic data to derive NAVAID coverage. In figure 15, note the DLS VORTAC. On tape 3, the ECAC and NAM site elevations were the same. However, on the later tape (7), there is a difference of 386 feet. For the earlier data, ECAC used the published site elevation; but for tape 7, the site location was derived from the terrain data itself. This resulted from ECAC's analysis that NAVAID coverage would be more accurate if the data used in the LOS formula were derived from the same source. In other words, if errors in the data were relative, they would tend to cancel out. These findings were not confirmed through application in deriving facility coverage data, and therefore NAFEC elected to do so through use of flight check data. These analyses will be discussed later in the report. In any event, the NAVCHK output provided a quick method of identifying questionable site elevations in the ECAC file. Where these

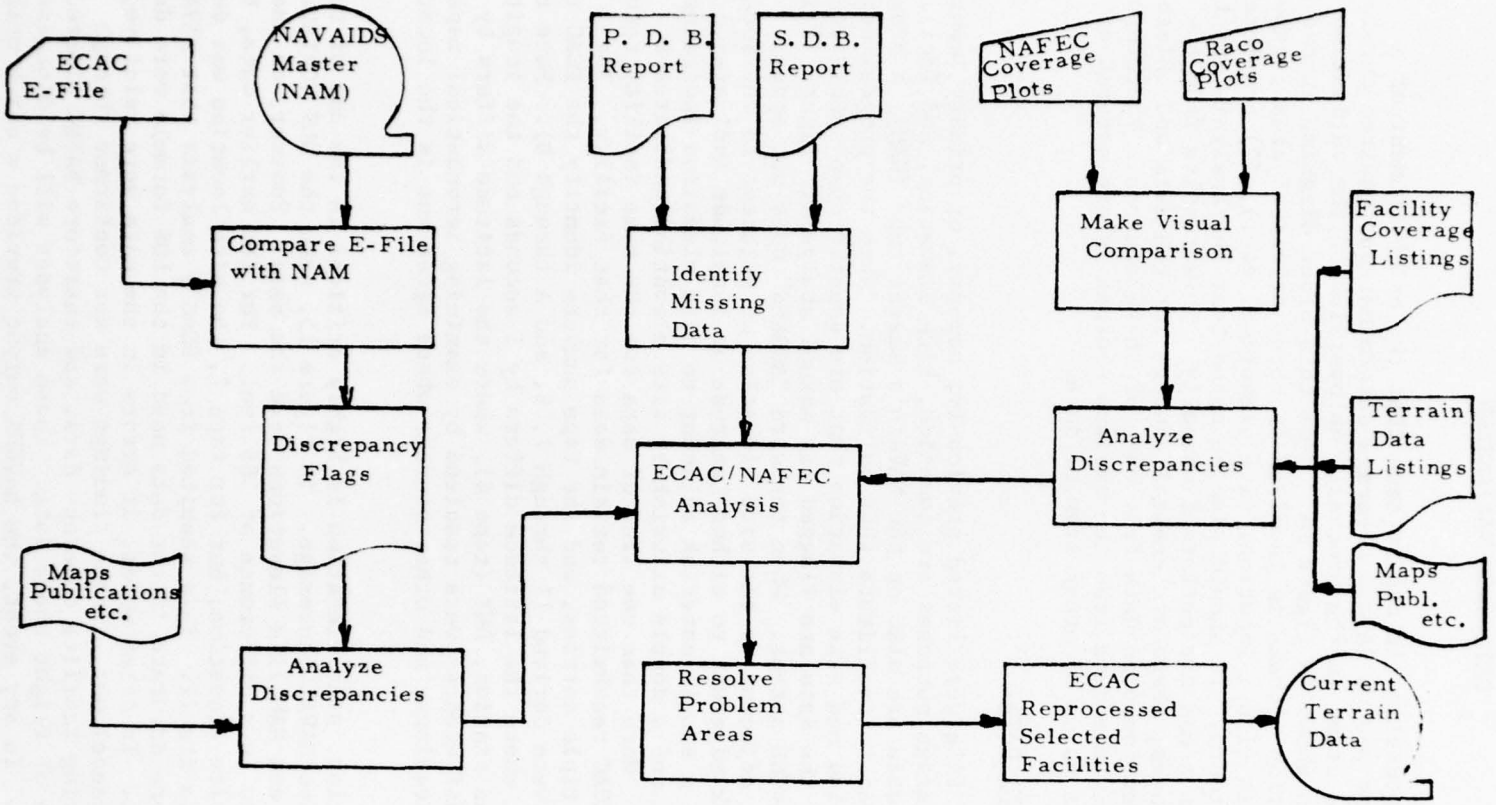


FIGURE 14. DATA BASE VALIDATION PROCESS

Ident. NAM	Type/Class ECAC		NAM	Latitude ECAC		NAM	Longitude ECAC		NAM	Site Elev ECAC		NAM	Ant. HT. ECAC			Tape Number	
CLF	H	C	H-VORTAC	292139		292139	1004613		1004613A	1060		1088	25	*** AGREES ***		(9)	
CLF	H	T	H-TACAN	292139	*	292144	1004613	*	1004622A	1060		1080	25			(9)	
CLG	C H	C	H-VORTAC	585942		585942	1583255		1583259P	127		157	16	*** AGREES ***		(1)	
CLH	H	C	H-BVORTAC	464808		464808	921210		921210P	860	*	1420 **	16			(7)	
CLH	H	C	H-BVORTAC	464808		464808	921210		921210P	1400		1420	34	*** AGREES ***		(9)	
CLH	H H	C	H-BVORTAC	464808		464808	921210		921210P	1420		1420	34	*** AGREES ***		(2)	
CLL	H L	C	L-BVORTAC	433303		433303	894549		894549G	1023		1020	35	*** AGREES ***		(3)	
CLN	C H	C	H-BVORTAC	451455		451455	1123247		1123247G	5250		5260	15	*** AGREES ***		(2)	
CLS	L	C	H-BVORTAC	454250		454250	1210559		1210559F	2835	*	3221 **	3			(7)	
CLS	H L	C	H-BVORTAC	454250		454250	1210559		1210559F	3221		3221	15	*** AGREES ***		(3)	
CMA	L	C	L-BVORTAC	321633		321633	1073618		1073618F	4305		4205	15	*** AGREES ***		(7)	
CMA	H L	C	L-BVORTAC	321633		321633	1073618		1073618F	4305		4205	36	*** AGREES ***		(3)	
CNY	L	C	L-VORTAC	401738		401738	873326		873326G	698		700	16	*** AGREES ***		(7)	
CNY	H L	C	L-BVORTAC	434942		434942	1102005		1102005F	7756		7720	22	*** AGREES ***		(3)	
CNY	V L	V	L-BVOR	421042		421042	745726		745726G	2380		2560 **	14			(A)	
CNY	V L	V	L-BVOR	421004	*	421042	745727		745726G	2560		2560	14			(4)	
DPA	V T	D	LABVORDME	415325		415325	882100		882100P	801		800	16	*** AGREES ***		(4)	
DPE	C L	C	L-VORTAC	404730		404730	731815		731815P	100		119	16	*** AGREES ***		(A)	

FIGURE 15. NAVCHK SAMPLE PAGE

occurred, an examination of charts and maps was made in an attempt to determine the correct value. These findings were then forwarded to ECAC, and, in several cases, the facility data were reprocessed for NAFEC use.

The NAVCHK listing also displays the facility type and class contained in E-File adjacent to these data found on the NAM tape. (The existing program does not flag differences in these data; but this feature can be added easily.) Through manual review, several discrepancies were found and corrected. For example, note the DLS VORTAC where ECAC data shows this facility to be an "L"-VORTAC (low-altitude) where, in fact, the facility is an H-VORTAC (high altitude) as shown in NAM data.

MISSING DATA.

As discussed earlier, the PDB and SDB provide an inventory of facilities for which data have been received from ECAC. Facilities on the NAM which are missing from the ECAC data are identified, and, if these facilities are still operational, the terrain data are requested from ECAC. Figure 6 depicts the current status of the NAFEC data base.

NAVAID COVERAGE VALIDATION.

Obviously, validation of the coverage derived from the terrain data is the most important part of the validation process. It is also the most difficult, since, in the final analysis, only a flight check of the facility can verify signal coverage at a given position and altitude. Furthermore, errors in coverage data can be the result of several factors, such as location, site elevation, map contour data, and human error. For these reasons it was decided to obtain all available flight check data from the Flight Inspection Branch, Aeronautical Center, Oklahoma City, Oklahoma. These data, referred to as random coverage (RACO) plots, were received for 118 facilities for flight checks at 18,000 feet and at 14,500 feet. Figure 16 is an example of the RACO plots. In order to use the RACO data effectively, the contours were encoded and processed in a manner compatible with the coverage data derived from terrain. Overlays were then made using the CALCOMP plotter (figure 17) to identify questionable coverage contours.

When a contour appeared questionable, all possible sources of error were examined. In particular, the angular data received from ECAC were a prime suspect. To examine these data, it was necessary to convert angular data to terrain height as shown in figures 8 and 9. Also, a plastic overlay (figure 18) was constructed such that on a sectional chart, terrain heights along the radials of a NAVAID could be compared with the PDB listing. Numerous cases were examined, and it was observed that, in general, the ECAC terrain data were lower than the map data. These findings were reported to ECAC, and it was concluded that such "flattening" of the terrain resulted from the interpolation method used in their data processsing. After further analysis, ECAC concluded that use of the highest point within the 1/2-mile grid would produce an improvement in these data. The ECAC programs were revised, and facilities with questionable coverage were reprocessed for NAFEC use. At this point, it should be pointed out that further improvement can be achieved by reducing the grid size of the terrain data that ECAC processes. Although the minimum grid

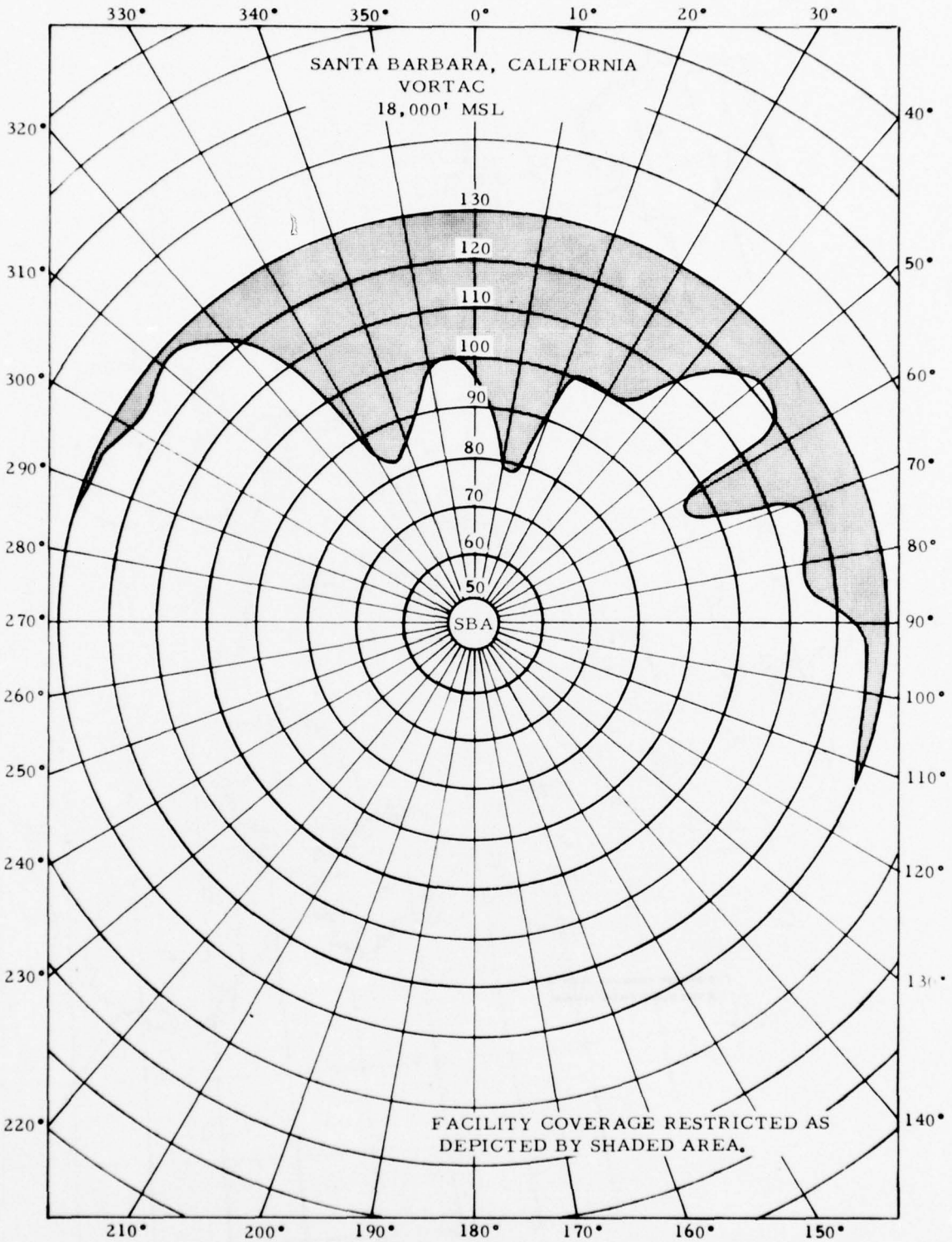


FIGURE 16. RACO COVERAGE PLOT

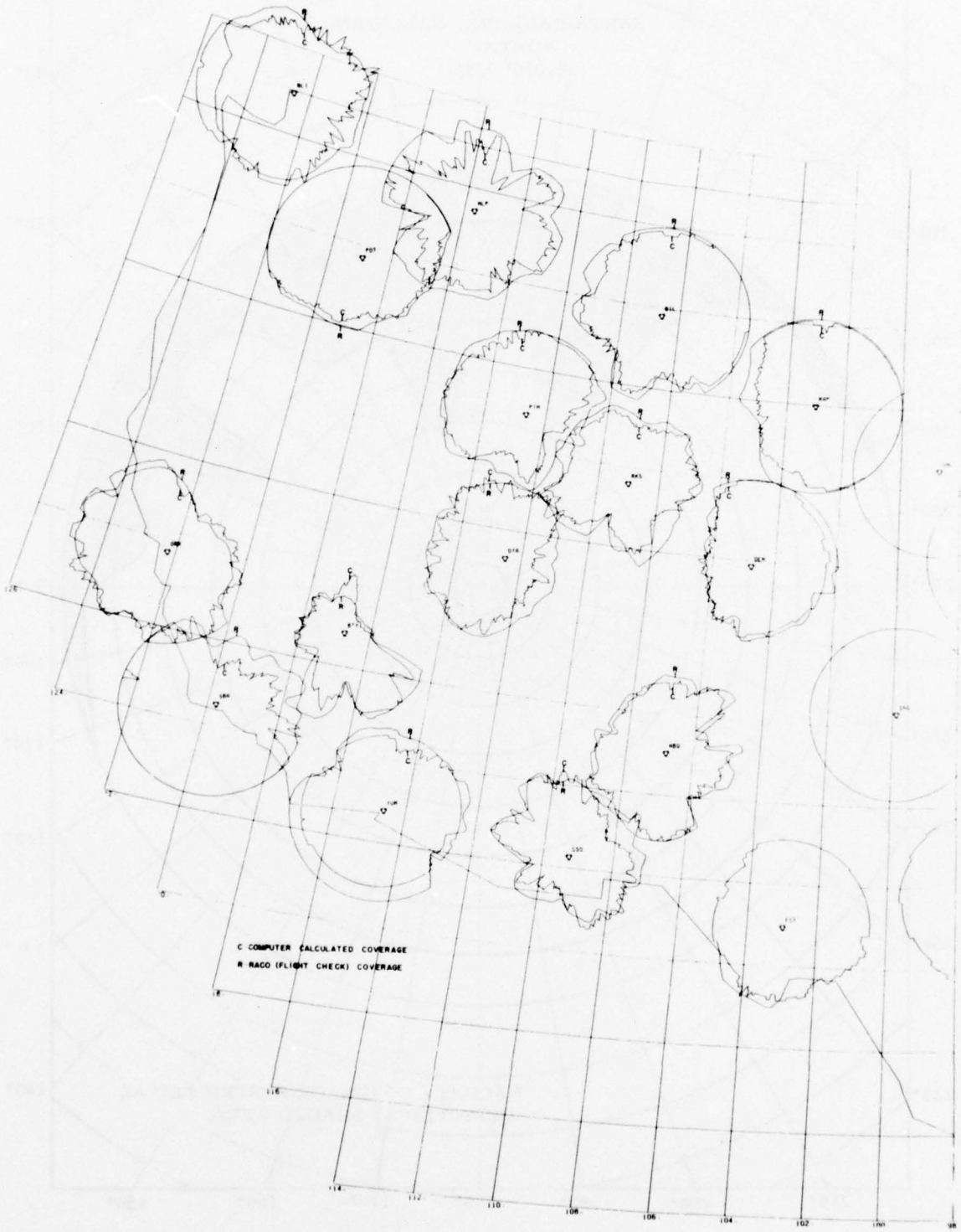


FIGURE 17. RACO AND TERRAIN-DERIVED COVERAGE PLOT

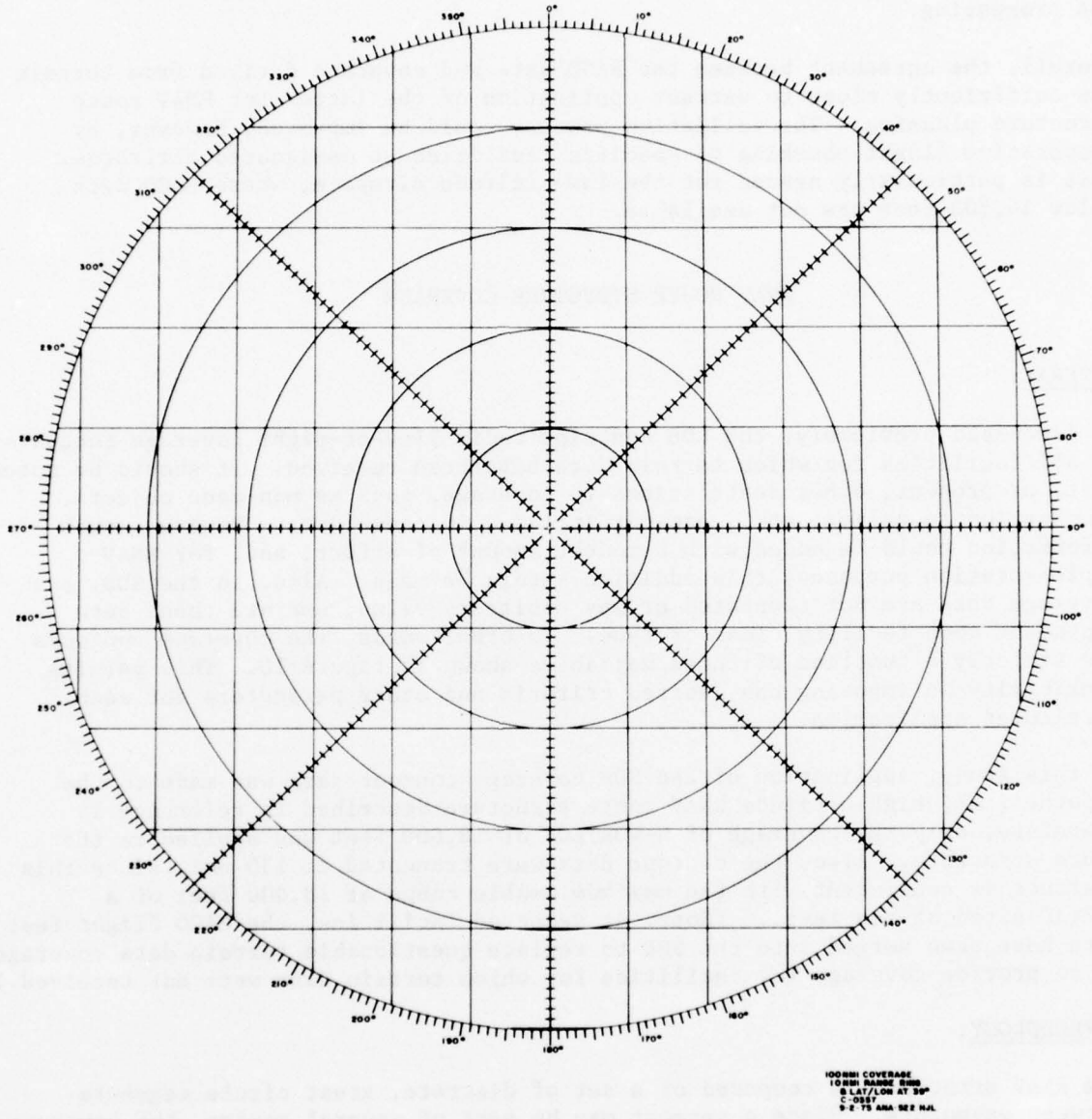


FIGURE 18. OVERLAY FOR TERRAIN ELEVATION VALIDATION

required has not, as yet, been determined, DMA produces data to within 3 seconds; therefore, considerable reduction is available without affecting DMA processing.

Overall, the agreement between the RACO data and coverage derived from terrain was sufficiently close to warrant application of the latter for RNAV route structure planning. The validation process could be improved, however, by cooperative flight checking of specific facilities at designated altitudes. This is particularly needed for the low-altitude airspace, where RACO data below 14,500 feet are not available.

RNAV ROUTE STRUCTURE COVERAGE

GENERAL.

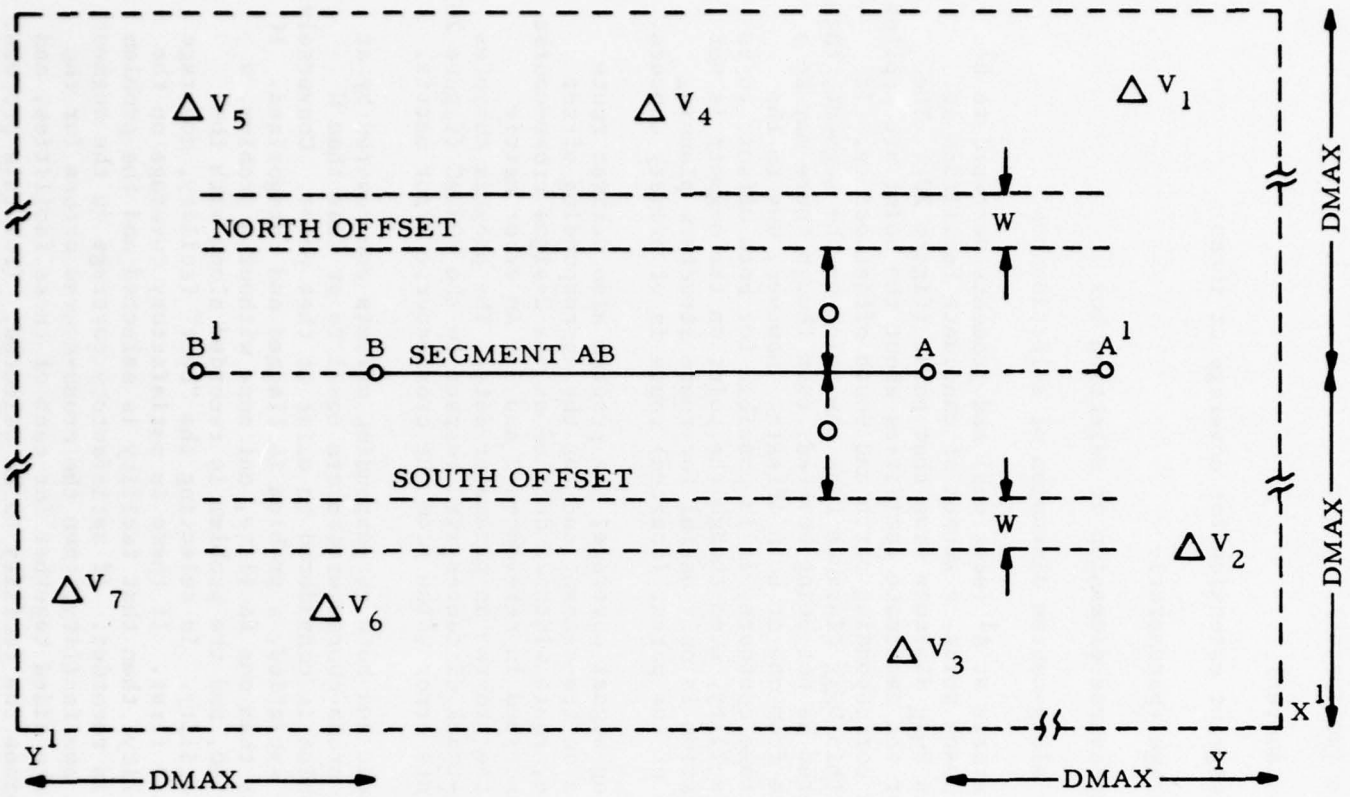
As discussed previously, the SDB contains radio line-of-sight coverage contours of all facilities for which terrain data have been received. It should be noted that, at present, other restrictions to coverage, such as man-made objects, propagation anomalies, etc., are not included in these data. However, such information could be added with a modest amount of effort, and, for RNAV implementation purposes, this addition should be made. Also, in the SDB, the coverage data are not truncated at any arbitrary value, nor are these data dependent upon facility class or type. In other words, the coverage contours are strictly a function of those variables shown in figure 10. This permits flexibility in imposing the desired criteria and other parameters for each particular application.

In this study, application of the SDB coverage contour data was made to the hypothetical, high-altitude RNAV route structure described in reference 1. Therefore, only the coverage of H-VORTACS at 18,000 feet was applied to the route structure. Also, the contour data were truncated at 130 nmi, since this distance is consistent with the maximum usable range at 18,000 feet of a VORTAC sited at sea level. (Note: At selected facilities, the RACO flight test data have been merged into the SDB to replace questionable terrain data coverage or to provide coverage for facilities for which terrain data were not received.)

METHODOLOGY.

The RNAV structure is composed of a set of discrete, great circle segments between waypoints. Since a segment may be part of several routes, the coverage for the set of discrete segments is determined first. The coverage for each route is then determined by linking together the coverage of those segments making up the particular route.

SEGMENT COVERAGE. To derive coverage for a segment, a set of VORTAC's is selected which are candidates to provide NAVAID coverage for that segment. This set of candidate facilities fall in a rectangular box around the segment, as shown in figure 19, where:



DMAX = COVERAGE AT SPECIFIED ALTITUDE
V_i = CANDIDATE VORTACS
W = ROUTE WIDTH CRITERIA (PARAMETER)
O = OFFSET DISTANCE (PARAMETER)
$AA^1 = BB^1 = W+O$ (SEGMENT EXTENSIONS FOR COVERAGE AT TURNS)

76-49-19

FIGURE 19. SELECTION BOX FOR CANDIDATE FACILITIES COVERING A SEGMENT

AB = segment

O = offset distance (parameter)

W = route width (parameter)

$AA^1 = BB^1 = O + W$ (segment extension for coverage at turns)

D_{MAX} = maximum coverage (parameter)

$XX^1 = 2\ D_{MAX}$ = cross-course dimension of selection box

$YY^1 = AB + 2\ D_{MAX}$ = along-course dimension of selection box

The coverage processing starts at A^1 (east end) and proceeds westward to B^1 at 1-mile intervals. At each point, a subset of candidate facilities is selected which are within D_{MAX} distance from that point (figure 20). The coverage contour data for the candidate facilities about the point are applied to that point and to the corresponding north and south offset points. If there are no VORTAC's within D_{MAX} distance from the point on the segment, then both offsets are considered as not being covered, even though there may be a VORTAC with D_{MAX} distance from one or both offsets. However, due to the irregularity of the coverage contours, it is possible for both offsets to be covered by a candidate facility, even though the point on the segment is not covered. This rare situation is only useful for route structure planning purposes, since coverage of the parent (charted) route is of primary concern.

In addition to determining signal coverage, the program also derives route width data for the points on the segment and for the corresponding offset points. For this purpose, route width is defined as the 2-sigma cross-course navigational error as described in references 2 and 3. An error matrix (figure 21) is input to the program as parameter data. The program computes the tangential and along-track distances with respect to the VORTAC (figure 20) and selects the appropriate error value from the cross-course error matrix.

If the point on the segment and both corresponding offsets are covered by at least one VORTAC and all cross-course errors are equal to or less than W (parameter), then no problem is considered to exist at that point. Conversely, if this condition is not satisfied, a problem is flagged and categorized. If there is coverage by more than one facility, but none without a problem, a "best" facility is selected, and the problem is recorded along with the identification of that facility. In selecting the "best" facility, coverage on the segment is examined first. If there is satisfactory coverage on the segment by only one facility, then that facility is selected and the problem for one or both offsets is recorded. If satisfactory coverage on the segment is provided by more than one facility, then the cross-course errors for the north and south offsets are added together for each of these facilities, and the minimum value determines the facility to be selected. (For this process, cross-course error for an offset is set at 99.9 miles when that offset is not covered.) If no facility provides satisfactory coverage on the segment, then the offset errors are added for all facilities that provide any coverage

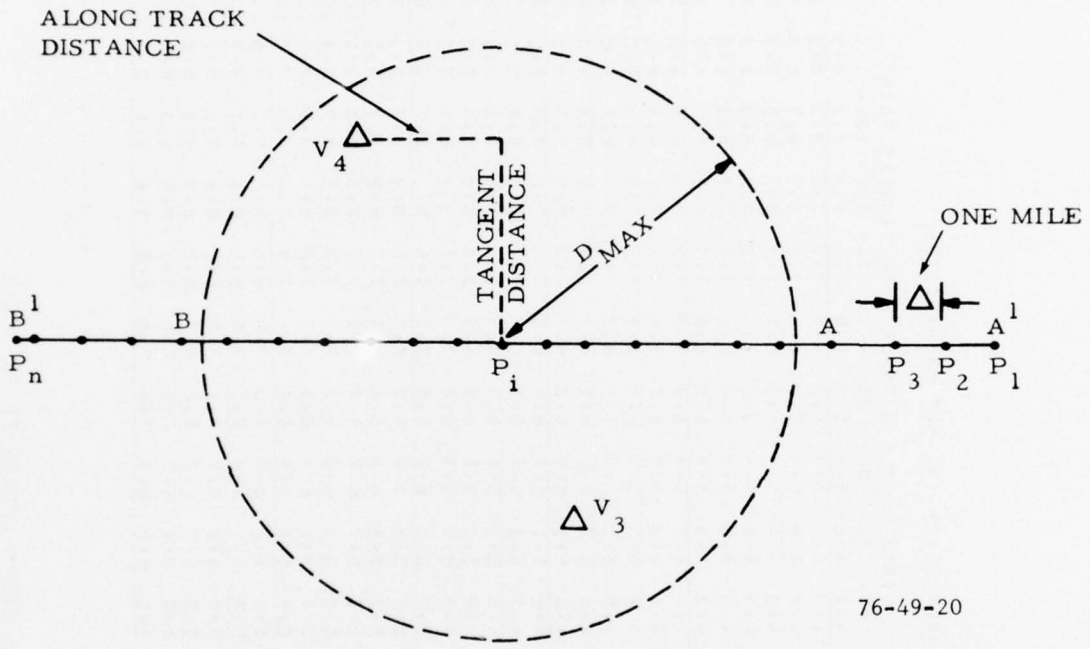


FIGURE 20. AREA CONTAINING CANDIDATE FACILITIES FOR COVERAGE

AREA NAVIGATION TRACK ERROR (90 PCT PROBABILITY)

PERP. DIST.	DISTANCE ALONG TRACK FROM TANGENT POINT																			
	0.	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.	110.	120.	130.	140.	150.	200.	250.	300.
0	2.1	2.2	2.4	2.8	3.2	3.7	4.3	4.8	5.4	5.9	6.5	7.1	7.7	8.3	8.9	9.5	12.6	15.6	18.7
5	2.1	2.2	2.4	2.8	3.2	3.7	4.3	4.8	5.4	5.9	6.5	7.1	7.7	8.3	8.9	9.5	12.6	15.6	18.7
10	2.1	2.2	2.4	2.8	3.2	3.7	4.3	4.8	5.4	5.9	6.5	7.1	7.7	8.3	8.9	9.5	12.6	15.6	18.7
15	2.1	2.2	2.4	2.8	3.2	3.7	4.3	4.8	5.4	6.0	6.5	7.1	7.7	8.3	8.9	9.5	12.6	15.6	18.7
20	2.1	2.2	2.5	2.8	3.3	3.8	4.3	4.8	5.4	6.0	6.5	7.1	7.7	8.3	8.9	9.5	12.6	15.6	18.7
25	2.2	2.3	2.5	2.9	3.3	3.8	4.3	4.8	5.4	6.0	6.6	7.1	7.7	8.3	8.9	9.5	12.6	15.6	18.7
30	2.3	2.3	2.6	2.9	3.3	3.8	4.3	4.9	5.4	6.0	6.6	7.2	7.7	8.3	8.9	9.5	12.6	15.6	18.7
35	2.3	2.4	2.6	3.0	3.4	3.8	4.4	4.9	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.6	12.6	15.6	18.7
40	2.4	2.5	2.7	3.0	3.4	3.9	4.4	4.9	5.5	6.0	6.6	7.2	7.8	8.4	9.0	9.6	12.6	15.6	18.7
45	2.5	2.5	2.7	3.1	3.5	3.9	4.4	5.0	5.5	6.1	6.6	7.2	7.8	8.4	9.0	9.6	12.6	15.7	18.7
50	2.6	2.6	2.8	3.1	3.5	4.0	4.5	5.0	5.5	6.1	6.7	7.2	7.8	8.4	9.0	9.6	12.6	15.7	18.7
55	2.6	2.7	2.9	3.2	3.6	4.0	4.5	5.0	5.6	6.1	6.7	7.3	7.9	8.4	9.0	9.6	12.6	15.7	18.7
60	2.7	2.8	3.0	3.3	3.7	4.1	4.6	5.1	5.6	6.2	6.7	7.3	7.9	8.5	9.1	9.7	12.7	15.7	18.8
65	2.8	2.9	3.1	3.4	3.7	4.2	4.6	5.1	5.7	6.2	6.8	7.3	7.9	8.5	9.1	9.7	12.7	15.7	18.8
70	2.9	3.0	3.2	3.5	3.8	4.2	4.7	5.2	5.7	6.3	6.8	7.4	8.0	8.5	9.1	9.7	12.7	15.7	18.8
75	3.1	3.1	3.3	3.6	3.9	4.3	4.8	5.3	5.8	6.3	6.9	7.4	8.0	8.6	9.1	9.7	12.7	15.7	18.8
80	3.2	3.2	3.4	3.6	4.0	4.4	4.8	5.3	5.8	6.4	6.9	7.5	8.0	8.6	9.2	9.8	12.7	15.8	18.8
85	3.3	3.3	3.5	3.7	4.1	4.5	4.9	5.4	5.9	6.4	7.0	7.5	8.1	8.6	9.2	9.8	12.8	15.8	18.8
90	3.4	3.4	3.6	3.8	4.2	4.6	5.0	5.5	6.0	6.5	7.0	7.6	8.1	8.7	9.3	9.8	12.8	15.8	18.8
95	3.5	3.6	3.7	3.9	4.3	4.6	5.1	5.5	6.0	6.5	7.1	7.6	8.2	8.7	9.3	9.9	12.8	15.8	18.9
100	3.6	3.7	3.8	4.1	4.4	4.7	5.2	5.6	6.1	6.6	7.1	7.7	8.2	8.8	9.3	9.9	12.9	15.8	18.9
105	3.8	3.8	3.9	4.2	4.5	4.8	5.2	5.7	6.2	6.7	7.2	7.7	8.3	8.8	9.4	10.0	12.9	15.9	18.9
110	3.9	3.9	4.1	4.3	4.6	4.9	5.3	5.8	6.2	6.7	7.3	7.8	8.3	8.9	9.4	10.0	12.9	15.9	18.9
115	4.0	4.1	4.2	4.4	4.7	5.0	5.4	5.9	6.3	6.8	7.3	7.8	8.4	8.9	9.5	10.1	13.0	15.9	18.9
120	4.1	4.2	4.3	4.5	4.8	5.1	5.5	5.9	6.4	6.9	7.4	7.9	8.4	9.0	9.5	10.1	13.0	16.0	19.0
125	4.3	4.3	4.4	4.6	4.9	5.2	5.6	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.6	10.2	13.0	16.0	19.0
130	4.4	4.4	4.6	4.8	5.0	5.3	5.7	6.1	6.6	7.0	7.5	8.0	8.6	9.1	9.7	10.2	13.1	16.0	19.0
135	4.5	4.6	4.7	4.9	5.1	5.4	5.8	6.2	6.7	7.1	7.6	8.1	8.6	9.2	9.7	10.3	13.1	16.1	19.0
140	4.7	4.7	4.8	5.0	5.2	5.6	5.9	6.3	6.7	7.2	7.7	8.2	8.7	9.2	9.8	10.3	13.2	16.1	19.1
145	4.8	4.8	4.9	5.1	5.4	5.7	6.0	6.4	6.8	7.3	7.8	8.3	8.8	9.3	9.8	10.4	13.2	16.1	19.1
150	5.0	5.0	5.1	5.3	5.5	5.8	6.1	6.5	6.9	7.4	7.8	8.3	8.8	9.4	9.9	10.4	13.2	16.2	19.1

DISTANCE FROM VORTAC TO TANGENT POINT

FIGURE 21. AC 90-45A CROSS-COURSE ERROR TABLE

(either on the segment, or on either offset, or any combination), and the minimum value again determines the "best" facility. In this context, "best" refers only to the program logic used for recording coverage problem data, and therefore, no operational or other considerations are implied. For this logic, highest priority is given to coverage on the parent route, and it is also assumed that coverage on the offset nearest the VORTAC will be equal to or better than that on the parent route. Therefore, an attempt is made to select a facility with satisfactory cross-course error on the parent route, even though one offset may not be covered. Obviously, if there is more than one facility that provides satisfactory coverage on the parent route, then the best offset coverage determines the best facility for recording purposes.

Figure 22 depicts a representative sample of segment coverage data. For this coverage, route width criteria (W) was set at 4.0 nmi, and offset (O) was set at 8.0 nmi. Coverage was derived for 18,000 feet and only the coverage contours of H-VORTAC's were applied.

As shown at the top of the page, coverage data are for segment number 117B which is 162.7 nmi long and which forms part of the routes from Boston to Miami (BOSMIAR1) and from Boston to Fort Lauderdale (BOSFLLR1). These routes are part of the high-altitude RNAV structure described in reference 1. The candidate VORTAC's are shown along the top of the page, with their location with respect to the segment in brackets below the VORTAC identification. The top number in brackets is the along-course distance of the VORTAC from the eastern-most end of the segment (i.e., the end with the smaller longitude). If this distance is preceded by a minus sign (-), the VORTAC is located east of the segment's east end. The bottom number in brackets is the cross-course distance from the VORTAC to the segment (i,e,, the distance from the VORTAC to the tangent point). If this number is preceded by a minus sign, the VORTAC is on the south side of the segment.

The column headings "N," "R," and "S" identify coverage data for the north offset, parent route, and south offset, respectively. The columns of numbers down the left and right-hand sides of the page depict mileage points from the east end of the segment for which the adjacent coverage data apply. Note that although coverage is derived at 1-mile intervals, the listing only shows data where there is a change in the coverage data. Coverage computation starts at (O + W) distance preceding the segment end point, and mileage data on the east end segment extension are identified with a minus sign (in this case, "-12," since O equals 8 and W equals 4). The columnar coverage data are to the nearest 1/10 mile, with the decimal point implied (i.e., "48" means 4.8 nmi). The data on the far right adjacent to the mileage column indicate a problem at that mileage point. The problem is categorized for the parent route and for the north and south offsets as appropriate, where "Ø" means no coverage and "1" means cross-course error exceeds route width criterion. The three-letter identification shows the VORTAC for which the problem data were recorded and which was selected as the "best" facility at that point. Note that when there is more than one facility that provides satisfactory coverage on the segment and on both offsets, no attempt is made to select the "best" facility for coverage.

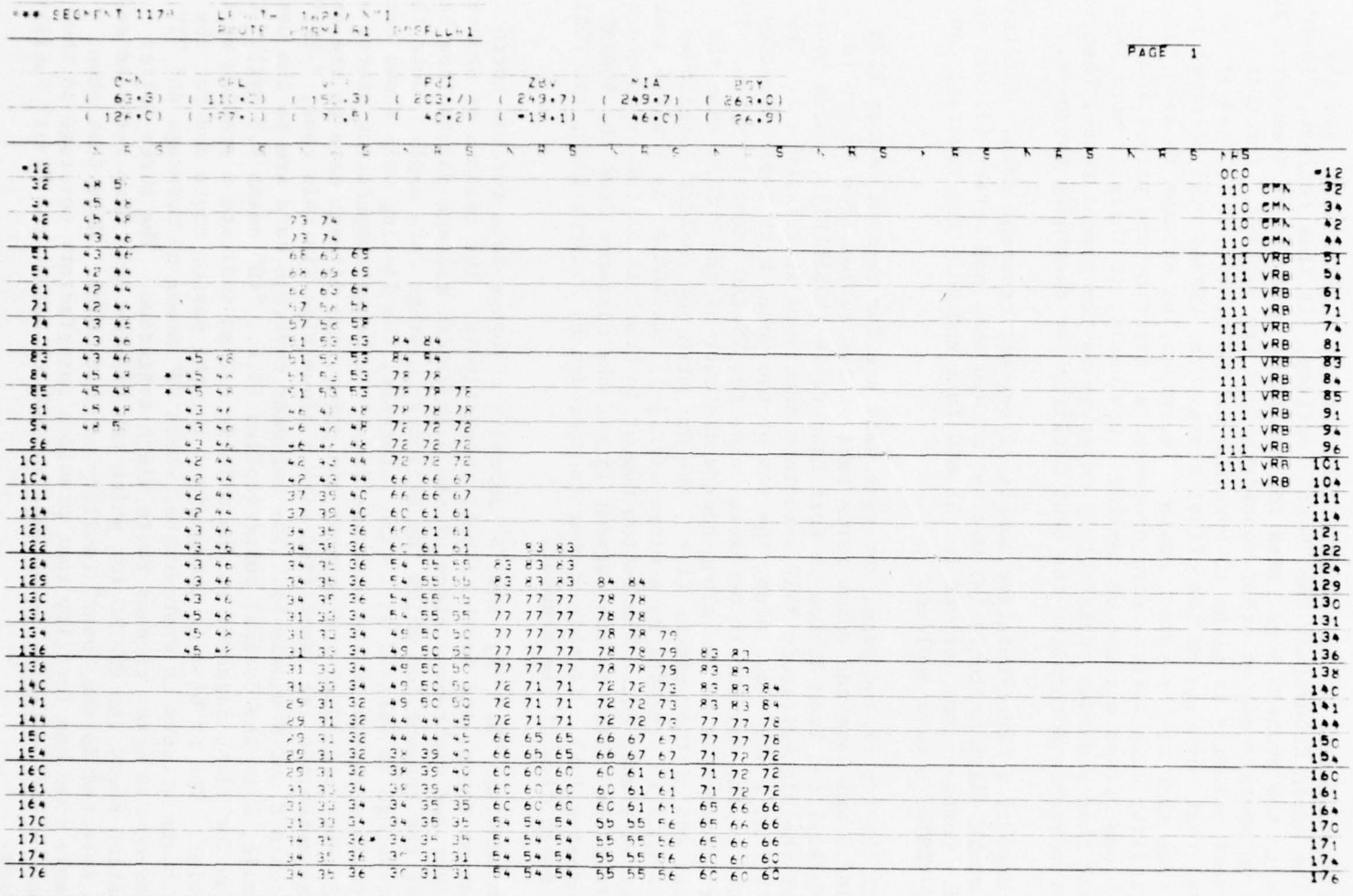


FIGURE 22. SEGMENT COVERAGE DATA

To understand the coverage data shown in figure 22, consider the following track along the segment:

a. Starting at mileage point -12 (i.e., east end of segment extension), there is no coverage (problem = 000) up to mile 32 on the segment.

b. At mile 32, coverage is provided by OMN for the segment (column R) and for the north offset (column N). However, the cross-course errors are 5.0 and 4.8 miles, respectively, which exceed the parameter W (4.0 nmi). Therefore, the problem at mile 32 is "110 OMN," which means that OMN is the best facility (in this case the only facility) at mile 32, but there is no coverage on the south offset and the cross-course errors on the segment and on the north offset exceed the route width criterion.

c. At mile 51, VRB replaces OMN as the "best" facility. Cross-course error exceeds the route width criterion for both facilities at this point. However, the south offset is not covered by OMN; therefore, the sum of 4.3 plus 99.9, as compared with 6.8 plus 6.9, results in the selection of VRB.

d. At mile 84, the asterisk (*) indicates that the cross-course error on the segment (4.8) is equal for both OMN and ORL. Note that VRB is still selected as the "best" facility.

e. After mile 111, there are no further problems recorded, since satisfactory coverage on the segment and on both offsets is provided by at least one facility.

f. At mile 154, both VRB and PBI provide satisfactory coverage, and at mile 171, the cross-course error for the two facilities is equal on the parent route segment.

g. Although the segment is 162.7 miles long, coverage data are derived up to mile 176, which encompasses the extension of the segment on the west end.

COVERAGE SUMMARIES. When the coverage processing of a segment is complete, the problem data are stored on magnetic tape as shown in figure 23. These data are then processed to produce summaries of coverage problems according to segments, routes, and overall network. For an explanation of these summaries, the following eight routes were selected from the high-altitude RNAV route structure described in reference 1:

Boston to Miami (BOSMIAR1)
Denver to Seattle (DENSEAR1)
Los Angeles to New York (LAXJFKR1)
Los Angeles to San Francisco (LAXSFOR1)
Los Angeles to San Francisco (LAXSFOR2)
Miami to Los Angeles (MIALAXR1)
Minneapolis to San Francisco (MSPSFOR1)
Seattle to New York (SEAJFKR1)

```
117B   26999999999
117B   27999999999
117B   28999999999
117B   29999999999
117B   30999999999
117B   31999999999
117B   32 48050999OMN
117B   33 48050999OMN
117B   34  45048999OMN
117B   35  45048999OMN
117B   36  45048999OMN
117B   37  45048999OMN
```

LEGEND

117B	Segment identification
32	Mileage point from segments east end
48	Cross course error on north offset = 4.8 mi.
050	Cross-course Error on Segment = 5.0 miles
999	South Offset not covered. (if not 999, data field gives cross-course error on the south offset)
OMN	VORTAC for which problem data apply and which was selected by the program as providing the best coverage at mile 32.
N	VORTAC is located north of segment

FIGURE 23. PROBLEM SEGMENT DATA TABLE

These routes were composed of 32 discrete segments and, as shown in figure 24, are representative in length, location, and direction.

Summary by Segments. Figure 25 shows the summary by segments of the coverage problems that were recorded when coverage for the above routes was processed using the cross-course error data shown in figure 21. In the columnar data, the "COV" column indicates the number of miles for which there was no coverage, and "ERR" is the number of miles for which the cross-course error exceeded the route width criterion (i.e., W = 4.0). Note for segment 117B (discussed earlier), that there are 32 miles over which the parent route segment and the north offset are not covered, and 51 miles where the south offset is not covered. Where there was coverage, the cross-course error exceeded the route width criterion for 79 miles on the parent route and on the north offset and for 60 miles on the south offset. The "ERR" and "COV" data add to 111 miles where there is a problem which is consistent with the data shown in figure 22. Of the 32 segments, 19 are shown in figure 25 as having problems; the other 13 being problem free.

Summary by Routes. An example of this summary is shown in figure 26 for the route from Boston to Miami. Although this route consists of four segments (P117, 117A, 117B, D117), only the two shown have coverage problems and for the mileage indicated. These miles are route miles starting at the east (BOS) end. In these data, cross-course errors are those for the facility (on the right-hand side) which was selected as providing the best coverage. A minus (-) sign indicates no coverage. Note that for route coverage, the offset data are given as "left" and "right," which is consistent with the direction of flight, Boston to Miami. Thus, it can be seen that the "south" offset data in figure 22 (segment 117B) have been converted to "left" offset where the segment forms part of the BOSMIA route. If these data were applied to the MIABOS (Miami to Boston), the converse would be true.

Problem Route Summary. An example of the coverage problem summary for all routes processed is shown in figure 27. In this case, eight routes were processed; but only the six had coverage problems. In this listing, the percentage values have been truncated (not rounded) at the percent shown (i.e., 4.7 percent is shown as 4).

Network Summary. Coverage problems for the total network are also summarized as per the example shown in figure 28. Of the eight routes processed, two (25 percent) were problem free; however, 6,553 miles (69.5 percent) were problem free. The latter data include all problem-free miles in the eight routes processed, not just the mileage of the two problem-free routes. The network route miles and the network segment miles are both shown as 9,423. However, this is only because the routes selected for this discussion all used different segments. Normally this is not the case, and the route miles would exceed the discrete segment miles in the network. Note, however, that there is a difference in the problem miles of the routes as compared to the segments. This results from the offset data around the turns, where the problems on the segment extension are included in the problem data on the route. The "away offset" data are for those cases where

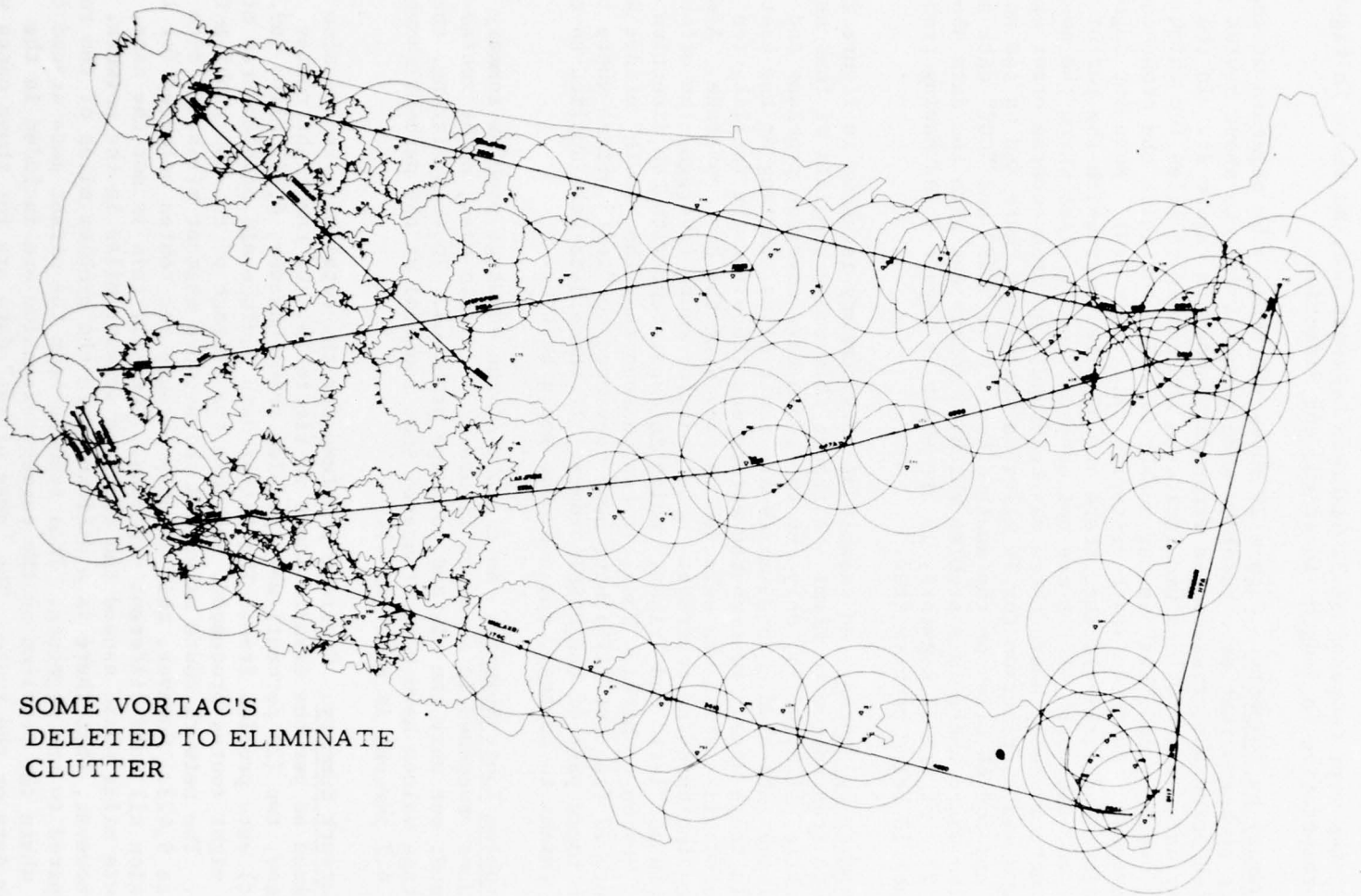


FIGURE 24. COVERAGE ON SELECTED ROUTES

**** SUMMARY BY SEGMENTS ****

SEGID	ROUTE COV	ROUTE ERR	OFFSET N COV	OFFSET N ERR	OFFSET S COV	OFFSET S ERR	SEGMENT LENGTH	ROUTE ID
CC1C	C	9	0	9	C	C	80	LAXJFKR3 STLLGAR1 LAXEWRR2 STLEWRR1 LAXJFKR2 LAXLGAR2 LAXEWRR3 STLJFKR1 PHXJFKR1 LAXLGAR3 SDFLGAR1
P341	C	33	0	23	C	33	61	MIALAXR1 MIAIAHR1
P364	C	C	15	0	C	C	54	SEAJFKR1 SEAMSPR1 SEABALR1 SEAIADR1
P29E	C	20	C	20	11	9	56	DENSEAR1
C56A	C	1	0	0	C	1	262	LAXLGAR2 LAXJFKR2 STLLGAR1 STLJFKR1 JFKSTLR1 JFKPHXR1 LAXEWRR2 JFKLAXR2 PHXJFKR1 STLEWRR1 EWRSTLR1 EWRLAXR2 LGASTLR1 LGALAXR2
117A	159	241	159	221	169	231	734	BOSMIAR1 BOSFLLR1 FLLBOSR1 MIABOSR1
117E	32	79	32	79	51	60	163	BOSMIAR1 BOSFLLR1
174B	C	31	C	31	C	28	202	LAXMIAR1 LAXIAHR1 IAHLAXR1 MIALAXR1
174C	C	30	C	30	C	2C	674	LAXMIAR1 LAXIAHR1 PHXIAHR1 IAHPHXR1 IAHLAXR1 MIALAXR1
238A	C	78	C	78	7	78	896	LAXLGAR2 LAXJFKR2 LAXIADR1 LAXEWRR2 LAXBALR1 STLLAXR1 JFKLAXR2 IADLAXR1 EWRLAXR2 LGALAXR2 BALLAXR1 LAXSTLR1
258C	17	193	55	172	42	156	686	DENSEAR1 SEADENR1
339A	C	453	10	511	1	38C	1746	JFKSEAR1 SEAJFKR1
341A	C	15	C	15	C	15	200	LAXMIAR1 MIALAXR1
365A	56	248	60	222	46	238	1005	SFOMSPR1 MSPSFOR1
365C	C	26	C	26	C	26	33	MSPSFOR1
381B	C	6	C	C	C	14	141	LAXLGAR2 LAXJFKR2 LAXIADR1 LAXEWRR2 STLPHXR1 STLLAXR1 LAXBALR1 JFKPHXR1 JFKLAXR2 PHXSTLR1 PHXJFKR1 ICTLUKR1 ICTCVGR1 IADLAXR1 CVGICTR1 EWRLAXR2 LUKICTR1 LGALAXR2 BALLAXR1 LAXSTLR1
385B	C	C	C	C	13	C	182	BOSSFOR1 SLCSFOR1 JFKSFOR3 ORDSFOR3 MSPSFOR1
4C3C	162	206	162	203	173	218	639	LAXMIAR1 IAHMIAR1 MIALAXR1 MIAIAHR1
447A	C	10	C	C	C	26	202	LAXLGAR2 LAXJFKR2 LAXEWRR2 JFKPHXR1 JFKLAXR2 PHXJFKR1 EWRLAXR2 LGALAXR2

FIGURE 25. PROBLEM SUMMARY BY SEGMENTS

**** SUMMARY BY ROUTES ****

ROUTE			CROSS-TRACK ERRORS OFFSET 1 (LEFT)	ROUTE	OFFSET 2 (RIGHT)	FACILITY
BCSP1AR1						
SEG 117A	250.1 TO	259.1	43	42	41	SIEN
	260.1 TO	269.1	48	47	46	SIEN
	270.1 TO	279.1	53	52	51	SIEN
	280.1 TO	286.1	58	57	56	SIEN
	287.1 TO	296.1	53	52	51	ORFN
	297.1 TO	306.1	48	47	46	ORFN
	307.1 TO	406.1	44	42	42	ORFN
	407.1 TO	416.1	48	47	46	ORFN
	417.1 TO	426.1	53	52	51	ORFN
	427.1 TO	436.1	58	57	57	ORFN
	437.1 TO	446.1	64	63	62	ORFN
	447.1 TO	449.1	65	64	63	ILMN
	450.1 TO	459.1	60	59	58	ILMN
	460.1 TO	469.1	55	54	53	ILMN
	470.1 TO	479.1	50	49	48	ILMN
	480.1 TO	489.1	46	45	43	ILMN
	490.1 TO	569.1	42	41	39	ILMN
	570.1 TO	579.1	46	45	43	ILMN
	580.1 TO	589.1	50	49	48	ILMN
	590.1 TO	599.1	55	54	53	ILMN
	600.1 TO	609.1	60	59	58	ILMN
	610.1 TO	619.1	65	64	63	ILMN
	620.1 TO	620.1	70	70	69	ILMN
	621.1 TO	629.1	-	70	69	ILMN
	630.1 TO	630.1	-	75	74	ILMN
	631.1 TO	789.1	-	-	-	
SEG 117B	789.9 TO	820.9	-	-	-	
	821.9 TO	822.9	-	50	48	OMAN
	823.9 TO	832.9	-	48	45	OMAN
	833.9 TO	839.9	-	46	43	OMAN
	840.9 TO	849.9	69	69	68	VRBN
	850.9 TO	859.9	64	63	62	VRBN
	860.9 TO	869.9	58	58	57	VRBN
	870.9 TO	879.9	53	53	51	VRBN
	880.9 TO	889.9	48	48	46	VRBN
	890.9 TO	899.9	44	43	42	VRBN

FIGURE 26. PROBLEM SUMMARY BY ROUTE, SEGMENT, AND MILEAGE POINT

****** PROBLEM ROUTE SUMMARY ****** (SP)= 4.0 MILES ; OFFSET DIST. = 8.0MILES

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE		NO LEFT-ES COVERAGE		NO RIGHT-ES COVERAGE		ROUTE WIDTH >(SP)		LEFT-ES >(SP)		RIGHT-ES >(SP)	
		MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)
BOSMIAR1	1018.2	191.0	(18)	220.0	(21)	191.0	(18)	460.0	(45)	431.0	(42)	380.0	(37)
CHISEAR1	798.1	17.0	(2)	53.0	(6)	59.0	(7)	396.0	(49)	365.0	(45)	392.0	(49)
LAX_FAR2	2046.3	.0	(0)	.0	(0)	14.0	(0)	94.0	(4)	77.0	(3)	133.0	(6)
MIALAXR1	1923.7	162.0	(8)	173.0	(8)	162.0	(8)	296.0	(15)	291.0	(15)	302.0	(15)
MSPSFOR1	1274.8	56.0	(4)	61.0	(4)	60.0	(4)	354.0	(27)	424.0	(33)	338.0	(26)
SEA_FAR1	2001.5	.0	(0)	25.0	(1)	1.0	(0)	713.0	(35)	781.0	(39)	650.0	(32)
TOTAL	9062.6	426.0	(4)	532.0	(5)	487.0	(5)	2313.0	(25)	2369.0	(26)	2195.0	(24)

FIGURE 27. PROBLEM ROUTE SUMMARY

****** NETWORK SUMMARY ******

ROUTE WIDTH = 4.0
OFFSET DIST. = 8.0

(A) ROUTE

NETWORK ROUTES	NUMBER	8	
	MILES	9423	
PROBLEM-FREE ROUTES	NUMBER	2	(25.00 %)
	MILES	6553	(69.54 %)
PROBLEM ROUTES	NUMBER	6	(75.00 %)
	MILES	2869	(30.46 %)

(B) SEGMENT

NETWORK SEGMENT	NUMBER	32	
	MILES	9423	
PROBLEM-FREE SEGMENT	NUMBER	13	(40.62 %)
	MILES	7112	(75.48 %)
PROBLEM SEGMENT	NUMBER	19	(59.37 %)
	MILES	2311	(24.52 %)
PARENT ROUTE HAS NO COVERAGE	MILES	426	(4.52 %)
AWAY OFFSET HAS NO COVERAGE	MILES	184	(1.95 %)
PARENT ROUTE WIDTH GT. (SP)	MILES	1679	(17.82 %)
AWAY OFFSET RT. WIDTH GT.(SP)	MILES	127	(1.35 %)

FIGURE 28. NETWORK SUMMARY - SELECTED ROUTES

the offset is on the opposite side of the route from the VORTAC. These data are additive to the parent route data. For example, the away offset has 184 more miles of no coverage than the parent route and 127 more miles where the cross-course error exceeded route width criteria.

APPLICATION OF COVERAGE CONTOURS TO AN RNAV ROUTE STRUCTURE.

In order to provide estimates regarding the capability of the present NAVAID system to support RNAV routes at or above 18,000 feet, it was decided to test the RNAV structure described in reference 1 against the coverage contour data developed by the methodology described in this report.

The RNAV structure (figure 29) consists of 1,018 routes connecting 450 airport pairs. Routes were formed by the interconnection of great circle segments starting at the boundary of the departure terminal and ending at the boundary of the arrival terminal. Each discrete segment could be used by several routes, which accounts for the difference between the number of segment-miles (151,309) and the number of route-miles (579,008). The selected airport pairs generate approximately 67 percent of the domestic, high-altitude traffic and, with only minor extensions, the structure could accommodate over 90 percent of the traffic in the high-altitude airspace. Although the structure is only hypothetical, the coverage data derived by using it as a test case should provide useful information for RNAV implementation planning.

Of the 297 H-VORTAC's in the conterminous U.S., 290 contours developed from terrain data were used for deriving route coverage data, while the remaining seven contours were taken from the RACO flight check data. Although terrain data were available for these facilities, the coverage contours developed from the data appeared somewhat questionable when compared with the flight-check data, and it was therefore decided to use the latter for this report.

In addition to signal coverage, route width and RNAV offset requirements must also be considered when examining the capability of a NAVAID system to support an RNAV route structure. Furthermore, these factors are directly related to air traffic control (ATC) requirements and to the assumed values for cross-course navigational errors. At the present time, the navigational errors being applied to RNAV routes are those published in Advisory Circular 90-45A, dated February 21, 1975. These data are shown in figure 21 of this report. The RNAV task force (reference 2) proposed that these errors could be substantially reduced provided certain improvements were made in the various elements which contribute to cross-course error. The task force error table is shown in figure 30. By assumption, route width is equal to the 2-sigma cross-course error value. Therefore, it can be seen from figures 21 and 30 that with a given route width requirement (i.e., $\pm$4 miles), the task force data permit substantially greater spacing between VORTAC's. Stated differently, with a given set of VORTAC's, application of the task force error data to an RNAV structure should render substantially fewer problem areas than the AC 90-45A data.

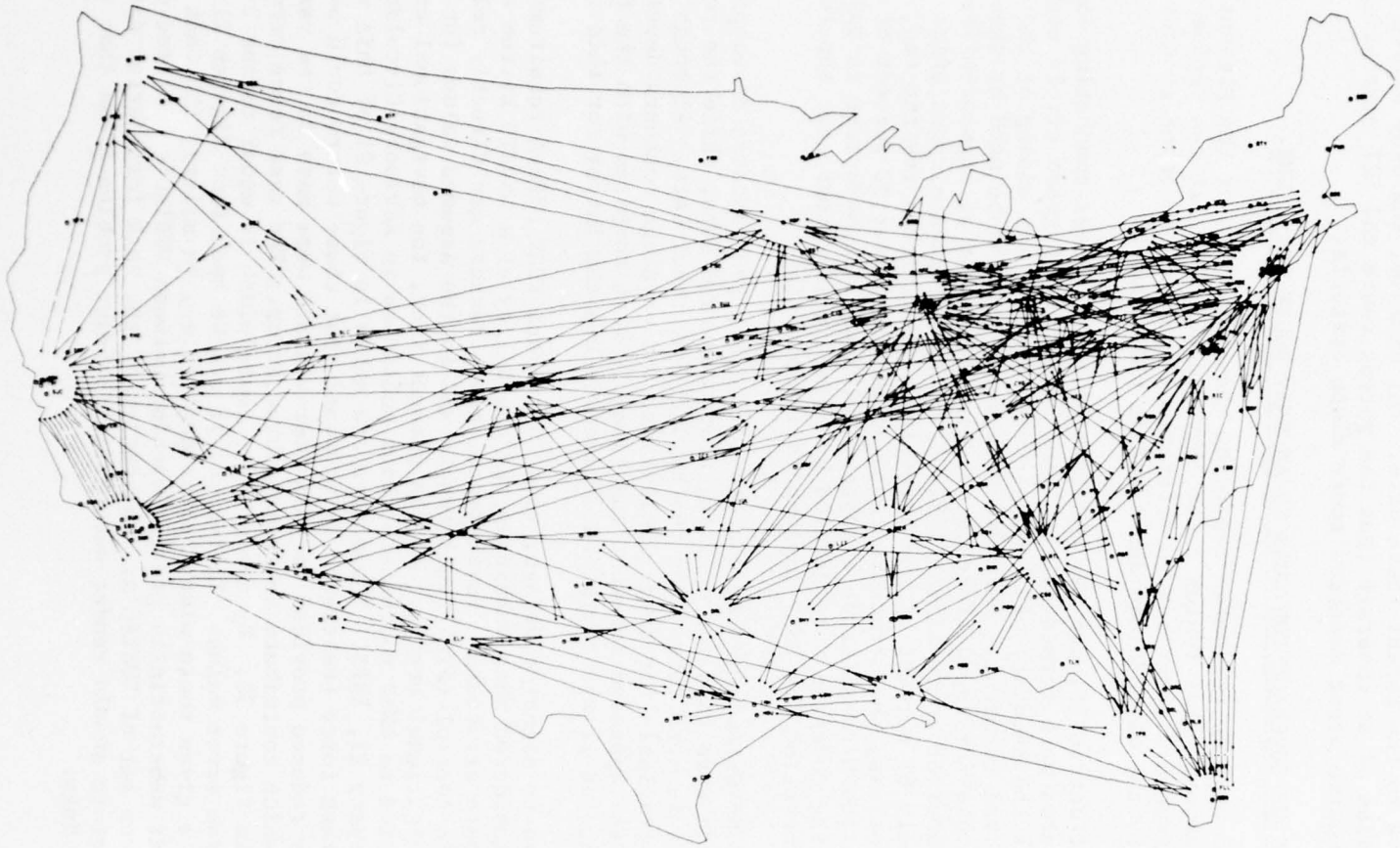


FIGURE 29. HYPOTHETICAL HIGH-ALTITUDE RNAV ROUTE STRUCTURE

** IMPROVED RNAV X-TRACK ERROR TABLE -- 95 PCT PROBABILITY-- **

DISTANCE FROM VORTAC TO TANGENT POINT / DISTANCE ALONG TRACK FROM TANGENT POINT	0.	10.	20.	30.	40.	50.	60.	70.	80.	90.	100.	110.	120.	130.	140.	150.
0.	1.1	1.2	1.3	1.5	1.8	2.1	2.5	2.8	3.1	3.5	3.8	4.2	4.6	4.9	5.3	5.7
5.	1.1	1.2	1.3	1.5	1.8	2.1	2.5	2.8	3.1	3.5	3.8	4.2	4.6	4.9	5.3	5.7
10.	1.2	1.2	1.3	1.5	1.8	2.1	2.5	2.8	3.1	3.5	3.8	4.2	4.6	4.9	5.3	5.7
15.	1.2	1.2	1.3	1.5	1.8	2.1	2.5	2.8	3.1	3.5	3.9	4.2	4.6	4.9	5.3	5.7
20.	1.2	1.2	1.3	1.6	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.2	4.6	4.9	5.3	5.7
25.	1.2	1.2	1.3	1.6	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.2	4.6	4.9	5.3	5.7
30.	1.2	1.2	1.3	1.6	1.8	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	4.9	5.3	5.7
35.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	4.9	5.3	5.7
40.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	5.0	5.3	5.7
45.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	5.0	5.3	5.7
50.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	5.0	5.3	5.7
55.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	5.0	5.3	5.7
60.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.8	3.2	3.5	3.9	4.2	4.6	5.0	5.3	5.7
65.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7
70.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7
75.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.3	5.7
80.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.3	5.7
85.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.3	5.7
90.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.4	5.7
95.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.4	5.7
100.	1.2	1.2	1.4	1.6	1.9	2.2	2.5	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.4	5.7
105.	1.2	1.2	1.4	1.6	1.9	2.2	2.6	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.4	5.7
110.	1.2	1.2	1.4	1.6	1.9	2.2	2.6	2.9	3.2	3.6	3.9	4.3	4.6	5.0	5.4	5.7
115.	1.2	1.2	1.4	1.6	1.9	2.2	2.6	2.9	3.2	3.6	3.9	4.3	4.7	5.0	5.4	5.7
120.	1.2	1.2	1.4	1.7	1.9	2.2	2.6	2.9	3.2	3.6	3.9	4.3	4.7	5.0	5.4	5.7
125.	1.2	1.2	1.4	1.7	1.9	2.2	2.6	2.9	3.2	3.6	3.9	4.3	4.7	5.0	5.4	5.7
130.	1.2	1.2	1.4	1.7	1.9	2.2	2.6	2.9	3.2	3.6	3.9	4.3	4.7	5.0	5.4	5.7
135.	1.2	1.2	1.4	1.7	1.9	2.3	2.6	2.9	3.3	3.6	4.0	4.3	4.7	5.0	5.4	5.7
140.	1.2	1.2	1.4	1.7	1.9	2.3	2.6	2.9	3.3	3.6	4.0	4.3	4.7	5.0	5.4	5.8
145.	1.2	1.2	1.4	1.7	1.9	2.3	2.6	2.9	3.3	3.6	4.0	4.3	4.7	5.0	5.4	5.8
150.	1.2	1.2	1.4	1.7	2.0	2.3	2.6	2.9	3.3	3.6	4.0	4.3	4.7	5.0	5.4	5.8

FIGURE 30. RNAV TASK FORCE CROSS-COURSE ERROR TABLE

To determine the magnitude of this difference, RNAV route coverage data were derived using each of these error tables. A comparison was also made with different route width criterion; viz, ±4 miles and ±5 miles. This comparison was made only with the AC 90-45A error data, since the 2-sigma error in the RNAV task force data is equal to or less than 5 miles when the along-track distance is 130 miles or less, which is the maximum distance for 18,000-foot coverage. For a higher altitude, the maximum distance would be increased, and the task force data would then be pertinent (figures 11 and 30). For each application, the "offset" parameter was set at twice the route width parameter, which, in effect, treats the coverage of the offset as an uncharted route, contiguous to the parent route, with centerline spacing consistent with the route width criterion.

From the above it can be seen that three sets of RNAV route coverage data were derived; namely:

1. AC 90-45A error; route width = ±4 miles; offset = 8 miles,

2. RNAV task force error; route width = ±4 miles; offset = 8 miles, and

3. AC 90-45A error; route width = ±5 miles; offset = 10 miles.

As discussed under the METHODOLOGY section, these data sets consist of:

1. Detailed coverage data for each segment,

2. A list of the segments which have coverage problems, with a summary by segment of these problems,

3. A list of the routes which have coverage problems showing where the problems are by segment and by mileage along the route,

4. An overall summary of the problem routes, and

5. A network summary.

Due to the volume of data, only the last two items were included in this report. Computer output of the other, more detailed data is retained in the project files for ready examination, which may be desirable to show more precisely where the NAVAID coverage problems are for the high-altitude airspace. Appendices A, B, and C contain the overall summaries for the routes with coverage problems tested under the three conditions shown above. The network summaries for these tests are depicted in figures 31, 32, and 33, respectively.

By comparing the data in figure 32 with those in figure 31, it can be seen that reductions in the cross-course error proposed by the RNAV Task Force would substantially reduce the RNAV route coverage problems. For example, of the 1,018 high-altitude RNAV routes in the hypothetical route structure, the routes with coverage problems were reduced from 664 (65.2 percent) to

****** NETWORK SUMMARY ******

ROUTE WIDTH = 4.0
OFFSET DIST. = 8.0

(A) ROUTE

NETWORK ROUTES	NUMBER	1018	
	MILES	579008	
PROBLEM-FREE ROUTES	NUMBER	354	(34.77 %)
	MILES	507519	(87.65 %)
PROBLEM ROUTES	NUMBER	664	(65.23 %)
	MILES	71489	(12.35 %)

(B) SEGMENT

NETWORK SEGMENT	NUMBER	1206	
	MILES	151309	
PROBLEM-FREE SEGMENT	NUMBER	755	(62.60 %)
	MILES	134050	(88.59 %)
PROBLEM SEGMENT	NUMBER	451	(37.40 %)
	MILES	17259	(11.41 %)
PARENT ROUTE HAS NO COVERAGE	MILES	1164	(.77 %)
AWAY OFFSET HAS NO COVERAGE	MILES	2010	(1.33 %)
PARENT ROUTE WIDTH GT. (SP)	MILES	13482	(8.91 %)
AWAY OFFSET RT. WIDTH GT.(SP)	MILES	1371	(.91 %)

FIGURE 31. NETWORK SUMMARY--HYPOTHETICAL RNAV ROUTE STRUCTURE (AC 90-45A CROSS-COURSE ERROR, ROUTE WIDTH = ±4 nmi)

****** NETWORK SUMMARY ******

ROUTE WIDTH = 4.0
OFFSET DIST. = 8.0

(A) ROUTE

NETWORK ROUTES	NUMBER	1018	
	MILES	579008	
PROBLEM-FREE ROUTES	NUMBER	867	(85.17 %)
	MILES	570131	(98.47 %)
PROBLEM ROUTES	NUMBER	151	(14.83 %)
	MILES	8876	(1.53 %)

(B) SEGMENT

NETWORK SEGMENT	NUMBER	1206	
	MILES	151309	
PROBLEM-FREE SEGMENT	NUMBER	1142	(94.69 %)
	MILES	148957	(98.45 %)
PROBLEM SEGMENT	NUMBER	64	(5.31 %)
	MILES	2352	(1.55 %)
PARENT ROUTE HAS NO COVERAGE	MILES	1161	(.77 %)
AWAY OFFSET HAS NO COVERAGE	MILES	1110	(.73 %)
PARENT ROUTE WIDTH GT. (SP)	MILES	114	(.08 %)
AWAY OFFSET RT. WIDTH GT.(SP)	MILES	0	(.00 %)

FIGURE 32. NETWORK SUMMARY--HYPOTHETICAL RNAV ROUTE STRUCTURE (RNAV TASK FORCE CROSS-COURSE ERROR, ROUTE WIDTH = ±4 nmi)

****** NETWORK SUMMARY ******

ROUTE WIDTH = 5.0
OFFSET DIST. = 10.0

(A) ROUTE

NETWORK ROUTES	NUMBER	1018	
	MILES	579008	
PROBLEM-FREE ROUTES	NUMBER	710	(69.74 %)
	MILES	556607	(96.13 %)
PROBLEM ROUTES	NUMBER	308	(30.26 %)
	MILES	22400	(3.87 %)

(B) SEGMENT

NETWORK SEGMENT	NUMBER	1206	
	MILES	151309	
PROBLEM-FREE SEGMENT	NUMBER	1030	(85.41 %)
	MILES	145906	(96.43 %)
PROBLEM SEGMENT	NUMBER	176	(14.59 %)
	MILES	5403	(3.57 %)
PARENT ROUTE HAS NO COVERAGE	MILES	1164	(.77 %)
AWAY OFFSET HAS NO COVERAGE	MILES	2445	(1.62 %)
PARENT ROUTE WIDTH GT. (SP)	MILES	2139	(1.41 %)
AWAY OFFSET RT. WIDTH GT.(SP)	MILES	117	(.08 %)

FIGURE 33. NETWORK SUMMARY--HYPOTHETICAL RNAV ROUTE STRUCTURE (AC 90-45A CROSS-COURSE ERROR, ROUTE WIDTH = ±5 nmi)

151 (14.8 percent). When looking at all route miles in the structure (579,008), the number of miles where coverage problems occurred was 8,876 (1.5 percent) when the task force error data were applied, as compared to 71,489 miles (12.4 percent) for the AC 90-45A error data. The problem data for the discrete line segments in the structure (1,206) also show a reduction of from 451 (37.4 percent) to 64 (5.3 percent). The reduction in problem miles along the segments is about the same as that accumulated over the routes. Also, the number of network miles where the route width exceeds ± 4 miles was reduced from 13,482 (8.9 percent) to 114 (.08 percent). It is apparent that with the RNAV task force cross-course error data, route width is not a problem with the number and location of H-VORTAC's presently in operation. The primary concern is whether or not here is signal coverage. Furthermore, of the 151,309 network miles, only 1,164 (less than 1 percent) were not within the coverage contours of the present system of H-VORTAC's. This is highly significant, since (a) the routes were designed without considering VORTAC location, (b) several routes are over water, and (c) coverage is computed at 18,000 feet, which is well below the normal flight plan altitude. For example, of the 1,164 miles that were not covered, 576 miles were on routes connecting to the Miami area. These routes, with long over-water segments, are normally flown at altitudes above 30,000 feet, and coverage distances at these altitudes are substantially increased (approximately proportional to the square root of the altitude). However, at greater distances route width also increases; therefore, the solution would probably be a trade-off between moving the routes closer to shore or using a wider route width. Also, L-VORTAC's may be available to cover the routes where H-VORTAC's do not.

Coverage problems on the offset located on the opposite side of the route from the VORTAC (AWAY OFFSET) also appear to be minimal. Note that, while the number of miles that the away offset is not covered when the parent route is covered is small in all cases, these data should not be affected by the cross-course error being applied. The difference in these data between figures 31 and 32 results from the logic used to select the preferred VORTAC (METHODOLOGY section). Revised logic has been developed, but was not applied for this data report.

The impact of different route width and offset criteria can be observed by comparing figure 33 with figure 31. Overall, the problem areas are reduced by a factor of over 3 to 1. In particular, the number of route miles where the route width criterion is exceeded is reduced from 13,482 (8.9 percent) to 2,139 (1.4 percent). As discussed in reference 1, route width requirements depend to a large extent on route density. Therefore, to more realistically assess this problem area, it would be necessary to localize where route width exceeds required values. The data generated by the NAFEC route coverage process are amenable to this type of analysis; however, the actual tabulation of these data is beyond the scope of this study.

SUMMARY AND CONCLUSIONS

Systematic implementation of area navigation in the National Airspace System requires that a continuous effort be made to identify NAVAID support requirements and to resolve potential problem areas. For the near-term planning phase, gross answers to the NAVAID support question are needed in order define the magnitude of the problem at an early date so that appropriate actions can be initiated in a timely manner. As the development of RNAV route structures progresses, and system requirements become firm, more detailed and specific data concerning NAVAID support will be required. The study reported on herein was established to support RNAV implementation in this area, both for the near-term period as well as for the longer range activities. This interim report reflects the work accomplished during the initial phase of this effort.

During this phase, a methodology was developed to provide needed information regarding the NAVAID support problem. This methodology is primarily computer-based and involves the application of topographic data to derive estimates of NAVAID coverage. Through data processing, RNAV routes can be tested against NAVAID coverage contours to identify problem areas and to derive other data associated with the support of RNAV routes provided by the NAVAID system. From the discussions in this report, it seems evident that the approach taken to derive the NAVAID support data is valid. Areas where the methodology should be improved upon are recognized, however. A limited amount of cooperative flight checking should be conducted, particularly in the low-altitude airspace, in order to further validate the process. Also, restrictions to coverage not caused by surrounding terrain should be accounted for. In addition, the software should be expanded to derive data not currently provided. For example, at present, only problems in route coverage, such as gaps and excessive route widths, are identified. For RNAV implementation, other data are needed including waypoint definition and frequency change-over points. This information can be derived manually from the data base developed by the present system. However, computer processing would greatly facilitate this effort.

Following the software development, a hypothetical high-altitude RNAV route structure was tested against the estimated coverage of the existing system of H-VORTAC's. This test demonstrated the usability of the methodology and, at the same time, produced some coarse-grained answers currently needed for RNAV implementation planning. From the resulting data, it appears that the present NAVAID system will support a high-altitude route structure with only a modest number of problem areas. Furthermore, the results should be considered as conservative estimates of the actual situation, due to certain limitations in the test itself. First, of course, the route structure was developmental in nature and was designed without consideration of NAVAID location and coverage. Therefore, many of the indicated problems could easily be resolved through minor route modifications which would not impact the efficiency of the structure. Also, the coverage data were computed for an altitude of 18,000 feet throughout the total network. This is not representative of the

normal enroute altitudes over the long, over-water segments and over the Rocky Mountain area. Also Canadian stations were not included, because data were not available. Thus, coverage gaps occurred in some of the northern routes where, in fact, adequate coverage exists. In addition to these limitations, no attempt was made to examine alternative solutions that may be possible; i.e., the use of L-VORTAC's and/or the upgrading of VOR's and TACAN's. Terrain data for these facilities are available, and their use to resolve coverage gaps can easily be determined. In connection with route width problems, it should be pointed out that these data are related to ATC requirements and to assumed values for cross-course navigational errors. The impact of applying different route width requirements and cross-course errors was demonstrated by the test. However, the extent that route width would be a problem with the present NAVAID system requires more definitive information regarding these factors.

The foregoing comments and qualifications notwithstanding, it can be concluded from this initial NAVAID support study that:

1. The use of topographic data to derive estimates of NAVAID coverage is a viable approach provided that:

   a. The terrain data base, facility locations, and site elevations are carefully verified,

   b. Computational parameters used to account for atmospheric refractivity, signal attenuation, etc., have been validated through an appropriate amount of flight testing, and

   c. Other restrictions to coverage, caused by man-made objects, propagation anomalies, and the like, are taken into account.

2. Terrain-derived coverage data can provide a valuable supplement to flight-check activities associated with RNAV implementation. In particular, these data can serve as a filter to reduce flight-checking costs by identifying potential restrictions to NAVAID coverage caused by surrounding terrain. Guidance for flight-check altitudes can be provided as can the identification of the radials on which the potential problems exist.

3. The present NAVAID system should support a high-altitude RNAV structure with only a modest number of problems to be resolved. More specifically:

   a. The problem of signal gaps on RNAV routes should be insignificant when all factors are considered and available solutions examined.

   b. With reduced cross-course navigational errors as depicted in the RNAV task force report, the route width problem is also insignificant. Where route width requirements are relaxed to ± 5 miles, the problem is also greatly reduced. Thus the final solution to this problem rests first, in the determination of ATC requirements (i.e., centerline spacing, minimum enroute altitudes (MEA), etc.) and second, in the directed improvement of specific NAVAID's.

4. The NAFEC methodology, with appropriate improvements, should become an integral part of the RNAV implementation program for application in determining NAVAID support requirements.

5. Implicit in the techniques, methodologies, and analyses in this report is the application to other types of facilities and usages. Among these would be radar, communications, and selection of proposed sites for all types of facilities.

REFERENCES

1. Halverson, Arthur G., et al., Area Navigation High-Altitude Network Study, U.S. Department of Transportation, Federal Aviation Administration, National Aviation Facilities Experimental Center, Atlantic City, New Jersey, 08405, Report No. FAA-RD-76-6, February 1976.

2. FAA/Industry RNAV Task Force, Application of Area Navigation in the National Airspace System, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., 20591, February 1973.

3. Advisory Circular No. 90-45A, Approval of Area Navigation Systems for Use in the U.S. National Airspace System, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., 20591, February 2, 1975.

APPENDIX A

PROBLEM ROUTE SUMMARY, HYPOTHETICAL RNAV ROUTE STRUCTURE, AC 90-45A CROSS-COURSE ERROR, ROUTE WIDTH = $\pm$4 NMI

****** PROBLEM ROUTE SUMMARY ****** (SP)= 4.0 MILES / OFFSET DIST. = 8.0MILES

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
ABGATLR1	1017.1	.0 (0)	.0 (0)	.0 (0)	120.0 (11)	129.0 (12)	96.0 (9)
ABGDALR1	401.7	.0 (0)	.0 (0)	.0 (0)	51.0 (12)	60.0 (14)	60.0 (14)
ABGDENR1	205.5	.0 (0)	3.0 (1)	18.0 (8)	15.0 (7)	15.0 (7)	18.0 (8)
ABGLANR1	489.1	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
ABGMCCR1	667.8	.0 (0)	15.0 (2)	15.0 (2)	66.0 (9)	66.0 (9)	66.0 (9)
ABGMDAR1	870.3	.0 (0)	.0 (0)	.0 (0)	36.0 (4)	45.0 (5)	27.0 (3)
ABGMIAR1	1374.5	78.0 (5)	78.0 (5)	108.0 (7)	291.0 (21)	255.0 (18)	303.0 (22)
ABGMSVR1	792.0	.0 (0)	.0 (0)	.0 (0)	102.0 (12)	114.0 (14)	111.0 (14)
ABGORDR1	870.3	.0 (0)	.0 (0)	.0 (0)	36.0 (4)	45.0 (5)	27.0 (3)
ABGPHXR1	200.6	.0 (0)	.0 (0)	.0 (0)	6.0 (2)	6.0 (2)	.0 (0)
ABGSFOR1	671.0	12.0 (1)	12.0 (1)	48.0 (7)	24.0 (3)	30.0 (4)	6.0 (0)
ABGTLSR1	189.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	3.0 (1)
ACHBKFR1	1189.6	.0 (0)	.0 (0)	.0 (0)	48.0 (4)	39.0 (3)	48.0 (4)
ALBBLER1	128.6	.0 (0)	.0 (0)	.0 (0)	9.0 (6)	6.0 (4)	9.0 (6)
AMACALR1	185.9	.0 (0)	.0 (0)	.0 (0)	63.0 (33)	63.0 (33)	72.0 (38)
ATLABGR1	1020.2	.0 (0)	.0 (0)	.0 (0)	120.0 (11)	96.0 (9)	129.0 (12)
ATLBALR1	385.1	.0 (0)	.0 (0)	.0 (0)	15.0 (3)	33.0 (8)	15.0 (3)
ATLBOSR1	742.6	.0 (0)	.0 (0)	.0 (0)	15.0 (2)	33.0 (4)	15.0 (2)
ATLBLER1	530.9	.0 (0)	12.0 (2)	.0 (0)	51.0 (9)	48.0 (9)	51.0 (9)
ATLCLER1	395.0	.0 (0)	.0 (0)	.0 (0)	63.0 (15)	63.0 (15)	63.0 (15)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-CS COVERAGE	% RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
ATLCLTR1	107.8	.0 (0)	.0 (0)	.0 (0)	12.0 (11)	9.0 (8)	12.0 (11)
ATLCALR1	55..1	.0 (0)	.0 (0)	.0 (0)	75.0 (13)	66.0 (11)	75.0 (13)
ATLCCAR1	385.1	.0 (0)	.0 (0)	.0 (0)	15.0 (3)	33.0 (8)	15.0 (3)
ATLCTAR1	427.7	.0 (0)	.0 (0)	.0 (0)	66.0 (15)	66.0 (15)	66.0 (15)
ATLEARR1	557.8	.0 (0)	.0 (0)	.0 (0)	15.0 (2)	33.0 (5)	15.0 (2)
ATLGSCR1	177.9	.0 (0)	.0 (0)	.0 (0)	12.0 (6)	18.0 (10)	12.0 (6)
ATLIACR1	385.1	.0 (0)	.0 (0)	.0 (0)	15.0 (3)	33.0 (8)	15.0 (3)
ATLIARR1	514.0	.0 (0)	.0 (0)	.0 (0)	21.0 (4)	18.0 (3)	21.0 (4)
ATLLFKR1	557.8	.0 (0)	.0 (0)	.0 (0)	15.0 (2)	33.0 (5)	15.0 (2)
ATLLARR1	1590.4	.0 (0)	3.0 (0)	.0 (0)	120.0 (7)	96.0 (6)	129.0 (8)
ATLLCAR1	557.8	.0 (0)	.0 (0)	.0 (0)	15.0 (2)	33.0 (5)	15.0 (2)
ATLMEMR1	204.8	.0 (0)	.0 (0)	.0 (0)	69.0 (33)	65.0 (33)	66.0 (32)
ATLPHLR1	493.8	.0 (0)	.0 (0)	.0 (0)	15.0 (3)	33.0 (6)	15.0 (3)
ATLPITR1	370.4	.0 (0)	12.0 (3)	.0 (0)	48.0 (12)	48.0 (12)	48.0 (12)
ATLRDLR1	223.3	.0 (0)	.0 (0)	.0 (0)	12.0 (5)	18.0 (8)	12.0 (5)
ATLSFOR1	1754.9	.0 (0)	12.0 (0)	30.0 (1)	276.0 (15)	276.0 (15)	297.0 (16)
ATLSTLR1	331.2	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
ATLTPAR1	265.8	.0 (0)	.0 (0)	.0 (0)	15.0 (5)	3.0 (1)	48.0 (18)
ALSELPR1	370.9	.0 (0)	.0 (0)	.0 (0)	57.0 (15)	57.0 (15)	48.0 (12)
BALATLR1	377.8	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	36.0 (9)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
BALBNAR1	390.9	.0 (0)	.0 (0)	.0 (0)	75.0 (19)	75.0 (19)	78.0 (19)
BALCMAR1	179.5	.0 (0)	.0 (0)	.0 (0)	21.0 (11)	33.0 (18)	12.0 (6)
BALCALR1	936.7	.0 (0)	.0 (0)	.0 (0)	201.0 (21)	201.0 (21)	204.0 (21)
BALCAYR1	238.1	.0 (0)	.0 (0)	.0 (0)	36.0 (15)	36.0 (15)	36.0 (15)
BALCENR1	1189.6	.0 (0)	.0 (0)	.0 (0)	48.0 (4)	39.0 (3)	48.0 (4)
BALLAMR1	1885.9	.0 (0)	3.0 (0)	.0 (0)	138.0 (7)	174.0 (9)	111.0 (5)
BALMCMR1	413.5	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	9.0 (2)
BALMIAR1	703.2	.0 (0)	.0 (0)	.0 (0)	90.0 (12)	141.0 (20)	66.0 (9)
BALMEYR1	744.0	.0 (0)	.0 (0)	.0 (0)	51.0 (6)	33.0 (4)	66.0 (8)
BALOMAR1	777.3	.0 (0)	.0 (0)	.0 (0)	21.0 (2)	33.0 (4)	12.0 (1)
BALORDR1	413.5	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	9.0 (2)
BALPITR1	93.9	.0 (0)	.0 (0)	.0 (0)	9.0 (9)	9.0 (5)	.0 (0)
BALSEAR1	1921.3	.0 (0)	.0 (0)	.0 (0)	282.0 (14)	264.0 (13)	330.0 (17)
BALSTLR1	524.0	.0 (0)	.0 (0)	.0 (0)	33.0 (6)	42.0 (8)	33.0 (6)
BDLCLER1	325.7	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
BDLMIAR1	950.9	75.0 (7)	138.0 (14)	75.0 (7)	321.0 (33)	408.0 (42)	294.0 (30)
BDLORDR1	591.5	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (0)
BDLPITR1	266.6	.0 (0)	.0 (0)	.0 (0)	21.0 (7)	21.0 (7)	21.0 (7)
BHMLANR1	94.7	.0 (0)	.0 (0)	.0 (0)	18.0 (19)	18.0 (19)	18.0 (19)
BHMLGAR1	650.7	.0 (0)	.0 (0)	.0 (0)	78.0 (11)	78.0 (11)	75.0 (11)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-BS COVERAGE	NO RIGHT-BS COVERAGE	ROUTE WIDTH >(SP)	LEFT-BS >(SP)	RIGHT-BS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
BWMMEMR1	93.3	.0 (0)	.0 (0)	.0 (0)	57.0 (61)	48.0 (51)	66.0 (70)
BWMERDR1	40.6	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
BWRADWR1	1189.6	.0 (0)	.0 (0)	.0 (0)	54.0 (4)	54.0 (4)	48.0 (4)
BWABALR1	387.6	.0 (0)	.0 (0)	.0 (0)	90.0 (23)	90.0 (23)	75.0 (19)
BWACALR1	458.3	.0 (0)	.0 (0)	.0 (0)	126.0 (27)	126.0 (27)	126.0 (27)
BWACCAR1	387.6	.0 (0)	.0 (0)	.0 (0)	90.0 (23)	90.0 (23)	75.0 (19)
BWAMEMR1	87.1	.0 (0)	.0 (0)	.0 (0)	75.0 (86)	75.0 (86)	75.0 (86)
BWAPPLR1	503.9	.0 (0)	.0 (0)	.0 (0)	90.0 (17)	75.0 (14)	90.0 (17)
BWAPITR1	312.5	.0 (0)	.0 (0)	.0 (0)	48.0 (15)	57.0 (18)	57.0 (18)
BCICEMR1	469.8	.0 (0)	.0 (0)	15.0 (3)	132.0 (28)	138.0 (29)	132.0 (28)
BCIFDWR1	209.6	.0 (0)	9.0 (4)	.0 (0)	42.0 (20)	42.0 (20)	42.0 (20)
BCISFCR1	348.9	48.0 (13)	54.0 (15)	42.0 (12)	42.0 (12)	36.0 (10)	51.0 (14)
BCISLOR1	16.0	.0 (0)	.0 (0)	.0 (0)	48.0 (29)	48.0 (29)	54.0 (32)
BCSATLR1	741.4	.0 (0)	.0 (0)	.0 (0)	21.0 (2)	30.0 (4)	36.0 (4)
BCSBLBR1	256.8	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	6.0 (2)	9.0 (3)
BCSCLBR1	402.0	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
BCSCALR1	1270.8	.0 (0)	6.0 (0)	.0 (0)	108.0 (8)	135.0 (10)	90.0 (7)
BCSCTWR1	467.7	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	6.0 (1)	15.0 (3)
BCSFLLR1	1018.2	192.0 (18)	219.0 (21)	192.0 (18)	459.0 (45)	432.0 (42)	378.0 (37)
BCSLAWR1	2162.0	.0 (0)	3.0 (0)	.0 (0)	39.0 (1)	33.0 (1)	39.0 (1)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
BCSMIAR1	1218.2	198.0 (18)	219.0 (21)	192.0 (18)	459.0 (45)	432.0 (42)	378.0 (37)
BCSORDR1	664.4	.0 (0)	.0 (0)	.0 (0)	21.0 (3)	6.0 (0)	24.0 (3)
BCSPITR1	343.6	.0 (0)	.0 (0)	.0 (0)	21.0 (6)	21.0 (6)	21.0 (6)
BCSSFOR1	2243.5	315.0 (14)	387.0 (17)	414.0 (18)	612.0 (27)	423.0 (18)	699.0 (31)
BCSSTLR1	826.2	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
BLFALBR1	132.6	.0 (0)	.0 (0)	.0 (0)	9.0 (6)	9.0 (6)	9.0 (6)
BLFATLR1	529.2	.0 (0)	.0 (0)	12.0 (2)	51.0 (9)	51.0 (9)	48.0 (9)
BLFBOSR1	260.4	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	9.0 (3)	9.0 (3)
BLFDTWR1	123.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (4)
BLFORDR1	314.6	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)
CHSDCAR1	290.7	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	9.0 (3)	9.0 (3)
CLEATLR1	392.1	.0 (0)	.0 (0)	.0 (0)	63.0 (16)	63.0 (16)	63.0 (16)
CLEBOLR1	330.4	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
CLEBOSR1	405.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
CLECALR1	806.3	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	27.0 (3)	96.0 (11)
CLELAXR1	1680.6	.0 (0)	30.0 (1)	.0 (0)	36.0 (2)	36.0 (2)	45.0 (2)
CLETPAR1	716.8	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	21.0 (2)
CLTATLR1	110.2	.0 (0)	.0 (0)	.0 (0)	3.0 (2)	.0 (0)	12.0 (10)
CLTCCAR1	191.6	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	12.0 (6)	3.0 (1)
CLTEXRR1	364.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	12.0 (3)	3.0 (0)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-OS COVERAGE	% RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
CLTWFKA1	364.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	12.0 (3)	3.0 (0)
CLTLCAA1	364.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	12.0 (3)	3.0 (0)
CLTMIAA1	476.2	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
CLTGRCA1	417.3	.0 (0)	9.0 (2)	.0 (0)	30.0 (7)	30.0 (7)	18.0 (4)
CLTFHLA1	300.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	12.0 (3)	3.0 (0)
CLTFITA1	229.4	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	.0 (0)	9.0 (3)
CMHBALA1	175.1	.0 (0)	.0 (0)	.0 (0)	21.0 (11)	21.0 (11)	33.0 (18)
CMHDCAA1	175.1	.0 (0)	.0 (0)	.0 (0)	21.0 (11)	21.0 (11)	33.0 (18)
CMHLGAA1	307.2	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
CMHMIAA1	774.8	.0 (0)	.0 (0)	3.0 (0)	15.0 (1)	12.0 (1)	15.0 (1)
CESMKCA1	380.5	.0 (0)	.0 (0)	.0 (0)	18.0 (4)	18.0 (4)	18.0 (4)
CVGICTA1	250.9	.0 (0)	.0 (0)	.0 (0)	48.0 (19)	54.0 (21)	42.0 (16)
DALABGA1	406.3	.0 (0)	.0 (0)	.0 (0)	48.0 (11)	57.0 (14)	48.0 (11)
DALAMAA1	184.5	.0 (0)	.0 (0)	.0 (0)	63.0 (34)	72.0 (39)	54.0 (29)
DALATLA1	550.5	.0 (0)	.0 (0)	.0 (0)	78.0 (14)	78.0 (14)	72.0 (13)
DALBALA1	934.6	.0 (0)	.0 (0)	.0 (0)	225.0 (24)	201.0 (21)	219.0 (23)
DALBNAA1	457.2	.0 (0)	.0 (0)	.0 (0)	135.0 (29)	126.0 (27)	129.0 (28)
DALBSGA1	1277.2	.0 (0)	.0 (0)	6.0 (0)	90.0 (7)	75.0 (5)	105.0 (8)
DALCLEA1	801.5	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	90.0 (11)	27.0 (3)
DALDCAA1	934.6	.0 (0)	.0 (0)	.0 (0)	225.0 (24)	201.0 (21)	219.0 (23)

ROUTE ID	ROUTE MILES	NB ROUTE COVERAGE	SB LEFT-ES COVERAGE	NB RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
CALCENR1	474.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	15.0 (3)	.0 (0)
CALCTYR1	769.7	.0 (0)	.0 (0)	.0 (0)	54.0 (7)	60.0 (7)	45.0 (5)
CALELPR1	391.9	.0 (0)	.0 (0)	.0 (0)	51.0 (13)	42.0 (10)	48.0 (12)
CALIMPR1	934.6	.0 (0)	.0 (0)	.0 (0)	225.0 (24)	201.0 (21)	219.0 (23)
CALLAXR1	1110.8	.0 (0)	.0 (0)	.0 (0)	225.0 (20)	201.0 (18)	219.0 (19)
CALLAXR1	962.5	.0 (0)	21.0 (2)	.0 (0)	90.0 (9)	72.0 (7)	84.0 (8)
CALLBER1	153.6	.0 (0)	.0 (0)	.0 (0)	12.0 (7)	12.0 (7)	24.0 (15)
CALLGAR1	1110.8	.0 (0)	.0 (0)	.0 (0)	225.0 (20)	201.0 (18)	219.0 (19)
CALLITR1	177.4	.0 (0)	.0 (0)	.0 (0)	60.0 (33)	54.0 (30)	51.0 (28)
CALMAPR1	182.2	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	.0 (0)	6.0 (3)
CALMEXR1	28.3	.0 (0)	.0 (0)	.0 (0)	60.0 (21)	51.0 (17)	54.0 (18)
CALMIAR1	888.9	78.0 (8)	78.0 (8)	108.0 (12)	228.0 (25)	189.0 (21)	243.0 (27)
CALMKCR1	313.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	21.0 (6)
CALMSYR1	306.4	.0 (0)	.0 (0)	.0 (0)	39.0 (12)	48.0 (15)	51.0 (16)
CALORCR1	593.6	.0 (0)	.0 (0)	.0 (0)	225.0 (37)	246.0 (41)	264.0 (44)
CALPMXR1	671.0	.0 (0)	.0 (0)	.0 (0)	90.0 (13)	72.0 (10)	84.0 (12)
CALSFER1	1162.4	12.0 (1)	12.0 (1)	48.0 (4)	72.0 (6)	87.0 (7)	54.0 (4)
CALSTLR1	390.4	.0 (0)	.0 (0)	.0 (0)	54.0 (13)	54.0 (13)	42.0 (10)
CAYBALR1	237.7	.0 (0)	.0 (0)	.0 (0)	36.0 (15)	36.0 (15)	36.0 (15)
CAYDCAR1	237.7	.0 (0)	.0 (0)	.0 (0)	36.0 (15)	36.0 (15)	36.0 (15)

ROUTE ID	ROUTE MILES	[illegible] COVERAGE	LEFT-CS COVERAGE	RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
DAYLPAP1	371.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
DAYLCAP1	371.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
DAYTBEP1	371.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
DCAATLP1	377.-	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	36.0 (9)
DCABENP1	390.9	.0 (0)	.0 (0)	.0 (0)	75.0 (19)	75.0 (19)	78.0 (19)
DCACHEP1	291.-	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	9.0 (3)	9.0 (3)
DCACLTP1	19+.2	.0 (0)	.0 (0)	.0 (0)	9.0 (4)	9.0 (4)	18.0 (9)
DCACMPP1	175.9	.0 (0)	.0 (0)	.0 (0)	21.0 (11)	33.0 (18)	12.0 (6)
DCADALP1	33+.7	.0 (0)	.0 (0)	.0 (0)	201.0 (21)	201.0 (21)	204.0 (21)
DCADAYP1	23+.1	.0 (0)	.0 (0)	.0 (0)	36.0 (15)	36.0 (15)	36.0 (15)
DCAGSEP1	12?.2	.0 (0)	.0 (0)	.0 (0)	12.0 (9)	15.0 (12)	12.0 (9)
DCALAXP1	+57.8	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	9.0 (1)
DCAMCLP1	+13.5	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	9.0 (2)
DCAMEMP1	56?.3	.0 (0)	.0 (0)	.0 (0)	150.0 (26)	150.0 (26)	153.0 (27)
DCAMIDP1	7_3.2	.0 (0)	.0 (0)	.0 (0)	90.0 (12)	141.0 (20)	66.0 (9)
DCAMKEP1	++6.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	.0 (0)
DCAMSFP1	7?1.3	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	21.0 (2)
DCAPROP1	+13.5	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	9.0 (2)
DCAPITP1	93.9	.0 (0)	.0 (0)	.0 (0)	9.0 (9)	9.0 (9)	.0 (0)
DCASCRP1	312.8	.0 (0)	.0 (0)	.0 (0)	99.0 (31)	111.0 (35)	42.0 (13)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE		NO LEFT-OS COVERAGE		NO RIGHT-OS COVERAGE		ROUTE WIDTH >(SP)		LEFT-OS >(SP)		RIGHT-OS >(SP)	
		MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)
DCASTLR1	524.0	.0	(0)	.0	(0)	.0	(0)	33.0	(6)	42.0	(8)	33.0	(6)
DCATYSR1	284.9	.0	(0)	.0	(0)	.0	(0)	84.0	(29)	78.0	(27)	84.0	(29)
DENABGR1	207.7	.0	(0)	15.0	(7)	3.0	(1)	24.0	(11)	24.0	(11)	24.0	(11)
DENBALR1	1189.6	.0	(0)	.0	(0)	.0	(0)	54.0	(4)	54.0	(4)	48.0	(4)
DENBCIR1	474.9	.0	(0)	12.0	(2)	9.0	(1)	150.0	(31)	141.0	(29)	141.0	(29)
DENCALR1	475.0	.0	(0)	.0	(0)	.0	(0)	3.0	(0)	.0	(0)	15.0	(3)
DENCTYR1	900.0	.0	(0)	.0	(0)	.0	(0)	24.0	(2)	24.0	(2)	24.0	(2)
DENIACR1	1189.6	.0	(0)	.0	(0)	.0	(0)	54.0	(4)	54.0	(4)	48.0	(4)
DENIAMR1	665.4	.0	(0)	.0	(0)	.0	(0)	3.0	(0)	.0	(0)	15.0	(2)
DENICTR1	286.1	.0	(0)	.0	(0)	.0	(0)	30.0	(10)	33.0	(11)	45.0	(15)
DENLFRR1	1312.4	.0	(0)	.0	(0)	.0	(0)	21.0	(1)	21.0	(1)	18.0	(1)
DENLASR1	446.3	24.0	(5)	39.0	(8)	42.0	(9)	27.0	(6)	33.0	(7)	39.0	(8)
DENLAXR1	632.4	6.0	(0)	15.0	(2)	48.0	(7)	147.0	(23)	144.0	(22)	138.0	(21)
DENLGAR1	1312.4	.0	(0)	.0	(0)	.0	(0)	21.0	(1)	21.0	(1)	18.0	(1)
DENMARR1	397.9	.0	(0)	.0	(0)	.0	(0)	39.0	(9)	48.0	(12)	27.0	(6)
DENMCAR1	683.3	.0	(0)	.0	(0)	.0	(0)	24.0	(3)	24.0	(3)	24.0	(3)
DENMKCR1	383.0	.0	(0)	.0	(0)	.0	(0)	18.0	(4)	9.0	(2)	24.0	(6)
DENMKER1	701.8	.0	(0)	.0	(0)	.0	(0)	33.0	(4)	45.0	(6)	39.0	(5)
DENMSPR1	514.8	.0	(0)	.0	(0)	.0	(0)	57.0	(11)	69.0	(13)	57.0	(11)
DENPMAR1	333.3	.0	(0)	.0	(0)	.0	(0)	24.0	(7)	24.0	(7)	24.0	(7)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE MILES (%)	% LEFT-ES COVERAGE MILES (%)	% RIGHT-ES COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-ES >(SP) MILES (%)	RIGHT-ES >(SP) MILES (%)
DENMAD51	683.3	.0 (0)	.0 (0)	.0 (0)	24.0 (3)	24.0 (3)	24.0 (3)
DENPDX51	77.1	.0 (0)	12.0 (1)	15.0 (1)	186.0 (24)	177.0 (22)	189.0 (24)
DENPHX51	426.7	.0 (0)	3.0 (0)	21.0 (4)	33.0 (7)	33.0 (7)	33.0 (7)
DENSEA51	798.1	.0 (0)	42.0 (5)	36.0 (4)	234.0 (29)	231.0 (28)	237.0 (29)
DENSFO51	721.4	.0 (0)	21.0 (2)	12.0 (1)	108.0 (14)	90.0 (12)	111.0 (15)
DENSLC51	721.4	.0 (0)	21.0 (2)	12.0 (1)	108.0 (14)	90.0 (12)	111.0 (15)
DENSLC-1	242.6	.0 (0)	3.0 (1)	.0 (0)	42.0 (17)	42.0 (17)	42.0 (17)
DENSTL51	591.4	.0 (0)	.0 (0)	.0 (0)	48.0 (8)	30.0 (5)	51.0 (8)
DETMKE51	129.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (2)
DSMLAX51	1155.6	.0 (0)	3.0 (0)	51.0 (4)	171.0 (14)	165.0 (14)	153.0 (13)
DTWATL51	428.0	.0 (0)	.0 (0)	.0 (0)	66.0 (15)	66.0 (15)	66.0 (15)
DTWBOS51	469.0	.0 (0)	.0 (0)	.0 (0)	15.0 (3)	15.0 (3)	12.0 (2)
DTWBLF51	119.0	.0 (0)	.0 (0)	.0 (0)	6.0 (5)	3.0 (2)	6.0 (5)
DTWDAL51	779.6	.0 (0)	.0 (0)	.0 (0)	54.0 (6)	45.0 (5)	66.0 (8)
DTWDEN51	805.2	.0 (0)	.0 (0)	.0 (0)	24.0 (2)	15.0 (1)	24.0 (2)
DTWEWR52	333.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)
DTWJFK52	333.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)
DTWLAX51	1616.1	.0 (0)	3.0 (0)	.0 (0)	39.0 (2)	33.0 (2)	39.0 (2)
DTWLGA52	333.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)
DTWMIA51	909.6	.0 (0)	.0 (0)	3.0 (0)	15.0 (1)	15.0 (1)	15.0 (1)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-OS COVERAGE MILES (%)	NO RIGHT-OS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-OS >(SP) MILES (%)	RIGHT-OS >(SP) MILES (%)
DTWMKER1	123.0	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (2)
DTWMSR1	369.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	21.0 (5)
DTWSFR1	1706.1	.0 (0)	9.0 (0)	18.0 (1)	150.0 (8)	141.0 (8)	156.0 (9)
DTWSYR1	236.4	.0 (0)	.0 (0)	.0 (0)	15.0 (6)	15.0 (6)	12.0 (5)
DTWTPR1	765.2	.0 (0)	.0 (0)	.0 (0)	45.0 (5)	36.0 (4)	57.0 (7)
ELPALR1	367.1	.0 (0)	.0 (0)	.0 (0)	42.0 (11)	42.0 (11)	75.0 (20)
ELPCAR1	390.1	.0 (0)	.0 (0)	.0 (0)	69.0 (17)	60.0 (15)	72.0 (18)
ELPLAR1	507.8	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	9.0 (1)
ELPLSR1	418.1	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
ELPMAR1	125.2	.0 (0)	.0 (0)	.0 (0)	9.0 (7)	21.0 (16)	9.0 (7)
ELPPXR1	211.8	.0 (0)	.0 (0)	.0 (0)	27.0 (12)	18.0 (8)	27.0 (12)
ELPSAR1	342.0	.0 (0)	.0 (0)	.0 (0)	72.0 (21)	57.0 (16)	81.0 (23)
ELPTLR1	145.5	.0 (0)	.0 (0)	.0 (0)	24.0 (16)	24.0 (16)	15.0 (10)
EWRATLR1	554.3	.0 (0)	.0 (0)	.0 (0)	21.0 (3)	30.0 (5)	36.0 (6)
EWRCLR1	259.8	.0 (0)	9.0 (3)	.0 (0)	3.0 (1)	3.0 (1)	3.0 (1)
EWRCLTR1	370.7	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	9.0 (2)	18.0 (4)
EWRFLR1	847.3	75.0 (8)	138.0 (16)	75.0 (8)	318.0 (37)	405.0 (47)	282.0 (33)
EWRGSR1	296.9	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	18.0 (6)	9.0 (3)
EWRIAR1	1126.6	.0 (0)	.0 (0)	27.0 (2)	90.0 (7)	96.0 (8)	192.0 (17)
EWRLAR1	618.0	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	60.0 (9)	24.0 (3)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE	LEFT-OS COVERAGE	RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
EWRLAWR1	2622.7	.0 (0)	.0 (0)	.0 (0)	27.0 (1)	42.0 (2)	27.0 (1)
EWRLAWR2	2731.0	.0 (0)	3.0 (0)	.0 (0)	102.0 (5)	144.0 (7)	66.0 (3)
EWRLAWR3	2746.3	.0 (0)	12.0 (0)	3.0 (0)	126.0 (6)	135.0 (6)	114.0 (5)
EWRMCWR1	514.3	.0 (0)	9.0 (1)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
EWRMIWR1	847.0	39.0 (4)	69.0 (8)	39.0 (4)	249.0 (29)	360.0 (42)	216.0 (25)
EWRMKCR1	858.6	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (0)	.0 (0)
EWRRCWR1	514.3	.0 (0)	9.0 (1)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
EWRSFCR1	2123.0	.0 (0)	9.0 (0)	21.0 (0)	177.0 (8)	177.0 (8)	306.0 (14)
EWRSTLR1	667.6	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	12.0 (1)	.0 (0)
EWRTPAR1	772.4	.0 (0)	.0 (0)	.0 (0)	33.0 (4)	60.0 (7)	24.0 (3)
FLLBCSR1	1720.5	177.0 (17)	177.0 (17)	213.0 (20)	477.0 (46)	366.0 (35)	441.0 (43)
FLLEWRR1	458.8	75.0 (8)	75.0 (8)	180.0 (20)	375.0 (43)	327.0 (38)	369.0 (42)
FLLWFKR1	458.8	75.0 (8)	75.0 (8)	180.0 (20)	375.0 (43)	327.0 (38)	369.0 (42)
FLLFPLR1	798.0	39.0 (4)	39.0 (4)	69.0 (8)	210.0 (26)	165.0 (20)	273.0 (34)
FLLFITR1	793.3	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)	15.0 (1)
GEGSFCR1	536.5	.0 (0)	6.0 (1)	6.0 (1)	189.0 (35)	198.0 (36)	186.0 (34)
GSCATLR1	184.9	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	.0 (0)	12.0 (6)
GSCDCAR1	119.6	.0 (0)	.0 (0)	.0 (0)	6.0 (5)	6.0 (5)	15.0 (12)
GSCEWBR1	292.3	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	15.0 (5)	3.0 (1)
GSCHPNR1	292.3	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	15.0 (5)	3.0 (1)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-ES COVERAGE	NO RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
GSCIADR1	115.6	.0 (0)	.0 (0)	.0 (0)	6.0 (5)	6.0 (5)	15.0 (12)
GSCLGAR1	292.3	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	15.0 (5)	3.0 (1)
GSCORDR1	410.1	.0 (0)	.0 (0)	.0 (0)	24.0 (5)	24.0 (5)	15.0 (3)
GSCTEBR1	292.3	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	15.0 (5)	3.0 (1)
HCLORDR1	704.8	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	3.0 (0)
HRNGSBR1	296.9	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	18.0 (6)	9.0 (3)
HRNMCWR1	514.3	.0 (0)	9.0 (1)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
IADCATR1	377.8	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	36.0 (9)
IADDALR1	936.7	.0 (0)	.0 (0)	.0 (0)	201.0 (21)	201.0 (21)	204.0 (21)
IADDEMR1	1189.6	.0 (0)	.0 (0)	.0 (0)	48.0 (4)	39.0 (3)	48.0 (4)
IADGSCR1	127.2	.0 (0)	.0 (0)	.0 (0)	12.0 (9)	15.0 (12)	12.0 (9)
IADLAXR1	1885.9	.0 (0)	3.0 (0)	.0 (0)	138.0 (7)	174.0 (9)	111.0 (5)
IADMCWR1	413.5	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	9.0 (2)
IADMEMR1	585.5	.0 (0)	.0 (0)	.0 (0)	150.0 (26)	150.0 (26)	153.0 (27)
IADMIAR1	703.2	.0 (0)	.0 (0)	.0 (0)	90.0 (12)	141.0 (20)	66.0 (9)
IADMSYR1	744.0	.0 (0)	.0 (0)	.0 (0)	51.0 (6)	33.0 (4)	66.0 (8)
IADOMAR1	777.3	.0 (0)	.0 (0)	.0 (0)	21.0 (2)	33.0 (4)	12.0 (1)
IADORDR1	413.5	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	30.0 (7)	9.0 (2)
IADPITR1	93.9	.0 (0)	.0 (0)	.0 (0)	9.0 (9)	9.0 (9)	.0 (0)
IADSEAR1	1921.3	.0 (0)	.0 (0)	.0 (0)	282.0 (14)	264.0 (13)	330.0 (17)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE	% LEFT-OS COVERAGE	% RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
IACSFCR1	1998.7	.0 (0)	18.0 (0)	12.0 (0)	159.0 (7)	132.0 (6)	156.0 (7)
IACSTLR1	524.0	.0 (0)	.0 (0)	.0 (0)	33.0 (6)	42.0 (8)	33.0 (6)
IAHATLR1	519.8	.0 (0)	.0 (0)	.0 (0)	21.0 (4)	21.0 (4)	18.0 (3)
IAHALCR1	32.3	.0 (0)	.0 (0)	.0 (0)	9.0 (27)	.0 (0)	9.0 (27)
IAHCEMR1	663.5	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	15.0 (2)	.0 (0)
IAHEWRR1	1132.5	.0 (0)	27.0 (2)	.0 (0)	90.0 (7)	192.0 (16)	96.0 (8)
IAHJFWR1	1132.5	.0 (0)	27.0 (2)	.0 (0)	90.0 (7)	192.0 (16)	96.0 (8)
IAHLAWR1	1178.5	.0 (0)	.0 (0)	.0 (0)	57.0 (5)	45.0 (4)	84.0 (7)
IAHLBER1	312.3	.0 (0)	.0 (0)	.0 (0)	48.0 (15)	48.0 (15)	57.0 (18)
IAHMIAR1	748.9	162.0 (21)	162.0 (21)	174.0 (23)	228.0 (30)	228.0 (30)	252.0 (33)
IAHMSAR1	178.1	.0 (0)	.0 (0)	.0 (0)	30.0 (16)	30.0 (16)	30.0 (16)
IAHORDR1	704.8	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	3.0 (0)
IAHPHWR1	785.(	.0 (0)	.0 (0)	.0 (0)	57.0 (7)	48.0 (6)	78.0 (9)
IAHSFCR1	1312.4	.0 (0)	12.0 (0)	24.0 (1)	114.0 (8)	99.0 (7)	90.0 (6)
IAHSTLR1	503.7	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	3.0 (0)
ICTCWCR1	253.8	.0 (0)	.0 (0)	.0 (0)	51.0 (20)	60.0 (23)	45.0 (17)
ICTDEMR1	286.5	.0 (0)	.0 (0)	.0 (0)	33.0 (11)	12.0 (4)	33.0 (11)
ICTLLWR1	253.8	.0 (0)	.0 (0)	.0 (0)	51.0 (20)	60.0 (23)	45.0 (17)
ICTMCWR1	419.9	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	9.0 (2)	36.0 (8)
ICTMKCR1	74.2	.0 (0)	.0 (0)	.0 (0)	15.0 (20)	27.0 (36)	15.0 (20)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-CS COVERAGE	% RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
ICTERCR1	409.9	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	9.0 (2)	36.0 (8)
INDEWBR1	468.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
IND_FWR1	468.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)
INDMEPR1	241.6	.0 (0)	.0 (0)	.0 (0)	27.0 (11)	93.0 (38)	27.0 (11)
_ANBHPR1	94.3	.0 (0)	.0 (0)	.0 (0)	18.0 (19)	18.0 (19)	18.0 (19)
_ANSHWR1	101.8	.0 (0)	.0 (0)	.0 (0)	27.0 (26)	15.0 (14)	27.0 (26)
_AXCCAR1	456.4	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	9.0 (1)
_AXEWBR1	618.7	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	24.0 (3)	60.0 (9)
_AX_FWR1	618.7	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	24.0 (3)	60.0 (9)
_AXLCAR1	618.7	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	24.0 (3)	60.0 (9)
_FKATLR1	554.3	.0 (0)	.0 (0)	.0 (0)	21.0 (3)	30.0 (5)	36.0 (6)
_FKCLER1	259.8	.0 (0)	9.0 (3)	.0 (0)	3.0 (1)	3.0 (1)	3.0 (1)
_FKCLTR1	370.7	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	9.0 (2)	18.0 (4)
_FKCALR1	1103.3	.0 (0)	.0 (0)	.0 (0)	201.0 (18)	201.0 (18)	204.0 (18)
_FKCENR1	1316.2	.0 (0)	.0 (0)	.0 (0)	9.0 (0)	9.0 (0)	9.0 (0)
_FKFLLR1	847.3	75.0 (8)	138.0 (16)	75.0 (8)	318.0 (37)	405.0 (47)	282.0 (33)
_FKIAWR1	1125.6	.0 (0)	.0 (0)	27.0 (2)	90.0 (7)	96.0 (8)	192.0 (17)
_FK_AXR1	618.0	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	60.0 (9)	24.0 (3)
_FKLABR1	1846.7	.0 (0)	3.0 (0)	21.0 (1)	15.0 (0)	111.0 (6)	24.0 (1)
_FKLAXR1	2[illegible]2.7	.0 (0)	.0 (0)	.0 (0)	27.0 (1)	42.0 (2)	27.0 (1)

BELTE IC	BELTE MILES	BELTE COVERAGE	LEFT-EB COVERAGE	RIGHT-EB COVERAGE	BELTE WIDTH >(SF)	LEFT-EB >(SF)	RIGHT-EB >(SF)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
↓FKLA↑R2	2131.0	.0 (0)	3.0 (0)	.0 (0)	102.0 (5)	144.0 (7)	66.0 (3)
↓FKLA↑R3	2 [illegible]	.0 (0)	12.0 (0)	3.0 (0)	126.0 (6)	135.0 (6)	114.0 (5)
↓FKMIAR1	[illegible]	7[illegible].0 (8)	138.0 (16)	75.0 (8)	318.0 (37)	405.0 (47)	282.0 (33)
↓FKMSFR1	7[illegible]	.0 (0)	.0 (0)	.0 (0)	42.0 (5)	135.0 (17)	42.0 (5)
↓FKMSMR1	918.0	.0 (0)	.0 (0)	.0 (0)	51.0 (5)	33.0 (3)	66.0 (7)
↓FKPAMR1	2123.0	.0 (0)	9.0 (0)	21.0 (0)	177.0 (8)	177.0 (8)	306.0 (14)
↓FKPRDR1	514.3	.0 (0)	9.0 (1)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
↓FKPRFR1	152.3	.0 (0)	.0 (0)	.0 (0)	54.0 (35)	54.0 (35)	54.0 (35)
↓FKFBIR1	791.0	39.0 (4)	69.0 (8)	39.0 (4)	249.0 (31)	360.0 (45)	216.0 (27)
↓FKFH↑R1	1765.8	.0 (0)	.0 (0)	.0 (0)	72.0 (4)	117.0 (6)	57.0 (3)
↓FKSAMR1	2[illegible]17.8	.0 (0)	3.0 (0)	.0 (0)	33.0 (1)	30.0 (1)	30.0 (1)
↓FKSE↑R1	1[illegible]5.5	.0 (0)	3.0 (0)	3.0 (0)	723.0 (36)	663.0 (33)	795.0 (39)
↓FKSFBR1	2123.0	.0 (0)	9.0 (0)	21.0 (0)	177.0 (8)	177.0 (8)	306.0 (14)
↓FKSFBR2	2125.3	.0 (0)	18.0 (0)	12.0 (0)	120.0 (5)	102.0 (4)	117.0 (5)
↓FKSFBR3	2141.1	24.0 (1)	54.0 (2)	84.0 (3)	249.0 (11)	225.0 (10)	219.0 (10)
↓FKS↓CR1	2123.0	.0 (0)	9.0 (0)	21.0 (0)	177.0 (8)	177.0 (8)	306.0 (14)
↓FKSTLR1	667.6	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	12.0 (1)	.0 (0)
↓FKTFAR1	772.4	.0 (0)	.0 (0)	.0 (0)	33.0 (4)	60.0 (7)	24.0 (3)
LASDEMR1	452.2	6.0 (1)	57.0 (12)	39.0 (8)	24.0 (5)	18.0 (3)	21.0 (4)
LAS↓FBR1	1[illegible]41.7	.0 (0)	21.0 (1)	3.0 (0)	21.0 (1)	30.0 (1)	111.0 (6)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE		NO LEFT-OS COVERAGE		NO RIGHT-OS COVERAGE		ROUTE WIDTH >(SP)		LEFT-OS >(SP)		RIGHT-OS >(SP)	
		MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)
LASCAWR1	252.2	.0	(0)	12.0	(4)	24.0	(9)	27.0	(10)	15.0	(5)	12.0	(4)
LASCRDR1	1220.1	6.0	(1)	42.0	(3)	39.0	(3)	51.0	(4)	54.0	(4)	57.0	(4)
LASPKWR1	130.7	.0	(0)	.0	(0)	.0	(0)	12.0	(9)	21.0	(16)	12.0	(9)
LASRNCR1	210.8	.0	(0)	9.0	(4)	57.0	(27)	3.0	(1)	.0	(0)	3.0	(1)
LASSFCR1	252.2	.0	(0)	12.0	(4)	24.0	(9)	27.0	(10)	15.0	(5)	12.0	(4)
LASSLGR1	252.2	.0	(0)	12.0	(4)	24.0	(9)	27.0	(10)	15.0	(5)	12.0	(4)
LASSLOR1	233.5	.0	(0)	.0	(0)	3.0	(1)	51.0	(21)	51.0	(21)	51.0	(21)
LAXABGR1	482.5	.0	(0)	.0	(0)	.0	(0)	3.0	(0)	3.0	(0)	3.0	(0)
LAXATLR1	1583.7	.0	(0)	.0	(0)	.0	(0)	120.0	(7)	129.0	(8)	96.0	(6)
LAXBALR1	1883.7	.0	(0)	.0	(0)	3.0	(0)	144.0	(7)	117.0	(6)	174.0	(9)
LAXBGSR1	2160.5	.0	(0)	.0	(0)	3.0	(0)	39.0	(1)	39.0	(1)	33.0	(1)
LAXCLER1	1674.3	.0	(0)	.0	(0)	30.0	(1)	36.0	(2)	45.0	(2)	36.0	(2)
LAXDAL1	961.5	.0	(0)	.0	(0)	21.0	(2)	90.0	(9)	84.0	(8)	72.0	(7)
LAXDENR1	629.9	.0	(0)	45.0	(7)	9.0	(1)	141.0	(22)	132.0	(20)	135.0	(21)
LAXDSMR1	1152.8	.0	(0)	51.0	(4)	3.0	(0)	171.0	(14)	153.0	(13)	165.0	(14)
LAXDTWR1	1612.5	.0	(0)	.0	(0)	3.0	(0)	39.0	(2)	39.0	(2)	33.0	(2)
LAXELPR1	503.1	.0	(0)	.0	(0)	.0	(0)	.0	(0)	.0	(0)	3.0	(0)
LAXEWRR1	2016.1	.0	(0)	.0	(0)	.0	(0)	33.0	(1)	33.0	(1)	36.0	(1)
LAXEWRR2	2046.3	.0	(0)	.0	(0)	3.0	(0)	93.0	(4)	75.0	(3)	132.0	(6)
LAXEWRR3	2052.1	.0	(0)	3.0	(0)	9.0	(0)	117.0	(5)	123.0	(5)	123.0	(5)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE	LEFT-BS COVERAGE	RIGHT-BS COVERAGE	ROUTE WIDTH >(SF)	LEFT-BS >(SF)	RIGHT-BS >(SF)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
LAXIADR1	1[illegible].7	.0 (0)	.0 (0)	3.0 (0)	144.0 (7)	117.0 (6)	174.0 (9)
LAXIABR1	1[illegible].5	.0 (0)	.0 (0)	.0 (0)	51.0 (4)	75.0 (6)	39.0 (3)
LAXLFKR1	2016.1	.0 (0)	.0 (0)	.0 (0)	33.0 (1)	33.0 (1)	36.0 (1)
LAXLFKR2	2[illegible].3	.0 (0)	.0 (0)	3.0 (0)	93.0 (4)	75.0 (3)	132.0 (6)
LAXLFKR3	2052.1	.0 (0)	3.0 (0)	9.0 (0)	117.0 (5)	123.0 (5)	123.0 (5)
LAXLGAR1	2016.1	.0 (0)	.0 (0)	.0 (0)	33.0 (1)	33.0 (1)	36.0 (1)
LAXLGAR2	2[illegible].3	.0 (0)	.0 (0)	3.0 (0)	93.0 (4)	75.0 (3)	132.0 (6)
LAXLGAR3	2052.1	.0 (0)	3.0 (0)	9.0 (0)	117.0 (5)	123.0 (5)	123.0 (5)
LAXMDWR1	1388.9	.0 (0)	.0 (0)	30.0 (2)	36.0 (2)	45.0 (3)	36.0 (2)
LAXMEWR1	129[illegible].3	.0 (0)	.0 (0)	.0 (0)	129.0 (9)	30.0 (2)	138.0 (10)
LAXMIAR1	1819.9	[illegible].0 (8)	162.0 (8)	174.0 (9)	291.0 (15)	306.0 (15)	291.0 (15)
LAXMKCR1	1[illegible].1	.0 (0)	.0 (0)	.0 (0)	27.0 (2)	27.0 (2)	36.0 (3)
LAXMSER1	1226.6	.0 (0)	6.0 (0)	.0 (0)	213.0 (17)	222.0 (18)	213.0 (17)
LAXMSWR1	1330.5	.0 (0)	12.0 (0)	21.0 (1)	105.0 (7)	120.0 (8)	102.0 (7)
LAXPMAR1	1[illegible].8	.0 (0)	51.0 (4)	3.0 (0)	171.0 (16)	153.0 (14)	165.0 (15)
LAXSRDR1	1388.9	.0 (0)	.0 (0)	30.0 (2)	36.0 (2)	45.0 (3)	36.0 (2)
LAXSRDR2	1393.8	.0 (0)	.0 (0)	3.0 (0)	39.0 (2)	39.0 (2)	33.0 (2)
LAXTCWR1	645.7	.0 (0)	.0 (0)	15.0 (2)	210.0 (32)	213.0 (32)	198.0 (30)
LAXTHLR1	198[illegible].9	.0 (0)	.0 (0)	.0 (0)	33.0 (1)	33.0 (1)	51.0 (2)
LAXSATR1	9[illegible].6	.0 (0)	.0 (0)	.0 (0)	72.0 (7)	72.0 (7)	84.0 (8)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
LAXSEAR1	736.0	3.0 (0)	.0 (0)	15.0 (2)	210.0 (28)	213.0 (28)	198.0 (26)
LAXSLOR1	417.1	.0 (0)	.0 (0)	.0 (0)	30.0 (7)	42.0 (10)	30.0 (7)
LAXSTLR1	1275.2	.0 (0)	.0 (0)	3.0 (0)	93.0 (7)	66.0 (5)	135.0 (10)
LBBCALR1	160.1	.0 (0)	.0 (0)	.0 (0)	21.0 (13)	21.0 (13)	21.0 (13)
LBBIAMR1	310.8	.0 (0)	.0 (0)	.0 (0)	33.0 (10)	36.0 (11)	33.0 (10)
LGAATLR1	554.3	.0 (0)	.0 (0)	.0 (0)	21.0 (3)	30.0 (5)	36.0 (6)
LGABHMR1	644.9	.0 (0)	.0 (0)	.0 (0)	78.0 (12)	75.0 (11)	78.0 (12)
LGACLER1	259.8	.0 (0)	9.0 (3)	.0 (0)	3.0 (1)	3.0 (1)	3.0 (1)
LGACLYR1	370.7	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	9.0 (2)	18.0 (4)
LGADALR1	1103.3	.0 (0)	.0 (0)	.0 (0)	201.0 (18)	201.0 (18)	204.0 (18)
LGADENR1	1315.2	.0 (0)	.0 (0)	.0 (0)	9.0 (0)	9.0 (0)	9.0 (0)
LGAGERR1	296.9	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	18.0 (6)	9.0 (3)
LGALAXR1	618.0	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	60.0 (9)	24.0 (3)
LGALAXR2	2022.7	.0 (0)	.0 (0)	.0 (0)	27.0 (1)	42.0 (2)	27.0 (1)
LGALAXR2	2031.0	.0 (0)	3.0 (0)	.0 (0)	102.0 (5)	144.0 (7)	66.0 (3)
LGALAXR3	2040.3	.0 (0)	12.0 (0)	3.0 (0)	126.0 (6)	135.0 (6)	114.0 (5)
LGAMDOR1	514.3	.0 (0)	9.0 (1)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
LGAMEMR1	732.1	.0 (0)	.0 (0)	.0 (0)	150.0 (20)	150.0 (20)	153.0 (20)
LGAMIAR1	847.0	30.0 (4)	69.0 (8)	33.0 (4)	249.0 (29)	360.0 (42)	216.0 (25)
LGAMKCR1	858.6	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE MILES (%)	% LEFT-BS COVERAGE MILES (%)	% RIGHT-BS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-BS >(SP) MILES (%)	RIGHT-BS >(SP) MILES (%)
LGAMSBR1	784.4	.0 (0)	.0 (0)	.0 (0)	42.0 (5)	138.0 (17)	42.0 (5)
LGACRBR1	158.3	.0 (0)	.0 (0)	.0 (0)	54.0 (35)	54.0 (35)	54.0 (35)
LGAFEIR1	781.0	39.0 (4)	69.0 (8)	39.0 (4)	249.0 (31)	360.0 (45)	216.0 (27)
LGASCBR1	467.5	.0 (0)	.0 (0)	.0 (0)	39.0 (8)	51.0 (10)	30.0 (6)
LGASPBR1	2183.0	.0 (0)	9.0 (0)	21.0 (0)	177.0 (8)	177.0 (8)	306.0 (14)
LGASTLR1	667.6	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	12.0 (1)	.0 (0)
LITCALR1	174.7	.0 (0)	.0 (0)	.0 (0)	51.0 (29)	51.0 (29)	51.0 (29)
LLKICTR1	250.9	.0 (0)	.0 (0)	.0 (0)	48.0 (19)	54.0 (21)	42.0 (16)
MAFCENR1	358.4	.0 (0)	.0 (0)	.0 (0)	27.0 (6)	18.0 (4)	30.0 (7)
MAFELBR1	125.1	.0 (0)	.0 (0)	.0 (0)	12.0 (9)	12.0 (9)	3.0 (2)
MCCABGR1	665.3	.0 (0)	12.0 (1)	15.0 (2)	69.0 (10)	69.0 (10)	69.0 (10)
MCWABGR1	669.7	.0 (0)	.0 (0)	.0 (0)	36.0 (4)	27.0 (3)	45.0 (5)
MCWBALR1	418.6	.0 (0)	.0 (0)	.0 (0)	33.0 (7)	33.0 (7)	33.0 (7)
MCWDCAR1	418.6	.0 (0)	.0 (0)	.0 (0)	33.0 (7)	33.0 (7)	33.0 (7)
MCWDENR1	687.0	.0 (0)	.0 (0)	.0 (0)	24.0 (3)	15.0 (2)	24.0 (3)
MCWIADR1	418.6	.0 (0)	.0 (0)	.0 (0)	33.0 (7)	33.0 (7)	33.0 (7)
MCWICTR1	407.6	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	9.0 (2)	9.0 (2)
MCWLAKR1	1396.5	.0 (0)	30.0 (2)	.0 (0)	36.0 (2)	36.0 (2)	45.0 (3)
MCWPHXR1	1149.7	.0 (0)	.0 (0)	18.0 (1)	18.0 (1)	30.0 (2)	15.0 (1)
MCWSFBR1	1486.2	.0 (0)	9.0 (0)	21.0 (1)	177.0 (11)	177.0 (11)	306.0 (20)

ROUTE ID	ROUTE MILES	NB ROUTE COVERAGE	NB LEFT-ES COVERAGE	NB RIGHT-ES COVERAGE	ROUTE WIDTH >(SF)	LEFT-ES >(SF)	RIGHT-ES >(SF)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
MEMATLR1	202.9	.0 (0)	.0 (0)	.0 (0)	69.0 (34)	66.0 (32)	69.0 (34)
MEMBHMR1	96.0	.0 (0)	.0 (0)	.0 (0)	69.0 (71)	60.0 (62)	72.0 (75)
MEMBNGR1	84.6	.0 (0)	.0 (0)	.0 (0)	75.0 (88)	75.0 (88)	75.0 (88)
MEMCALR1	285.6	.0 (0)	.0 (0)	.0 (0)	51.0 (17)	51.0 (17)	51.0 (17)
MEMDCAR1	562.0	.0 (0)	.0 (0)	.0 (0)	165.0 (29)	150.0 (26)	165.0 (29)
MEMIADR1	562.0	.0 (0)	.0 (0)	.0 (0)	165.0 (29)	150.0 (26)	165.0 (29)
MEMINDR1	243.0	.0 (0)	.0 (0)	.0 (0)	33.0 (13)	18.0 (7)	84.0 (34)
MEMLAXR1	1303.6	.0 (0)	3.0 (0)	.0 (0)	129.0 (9)	138.0 (10)	30.0 (2)
MEMLGAR1	738.2	.0 (0)	.0 (0)	.0 (0)	165.0 (22)	150.0 (20)	165.0 (22)
MEMMCWR1	321.6	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	.0 (0)	9.0 (2)
MEMORDR1	321.6	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	.0 (0)	9.0 (2)
MEMSCFR1	188.6	.0 (0)	.0 (0)	.0 (0)	69.0 (36)	75.0 (39)	48.0 (25)
MEMSHVR1	159.0	.0 (0)	.0 (0)	.0 (0)	24.0 (15)	36.0 (22)	24.0 (15)
MIAABGR1	1381.9	78.0 (5)	108.0 (7)	78.0 (5)	303.0 (21)	294.0 (21)	267.0 (19)
MIABALR1	710.3	.0 (0)	.0 (0)	.0 (0)	81.0 (11)	63.0 (8)	129.0 (18)
MIABCLR1	959.7	75.0 (7)	75.0 (7)	180.0 (18)	375.0 (39)	327.0 (34)	369.0 (38)
MIABGSR1	1020.5	177.0 (17)	177.0 (17)	213.0 (20)	477.0 (46)	366.0 (35)	441.0 (43)
MIACLYR1	475.0	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)
MIACMBR1	772.0	.0 (0)	3.0 (0)	.0 (0)	6.0 (0)	6.0 (0)	6.0 (0)
MIACALR1	888.1	78.0 (8)	108.0 (12)	78.0 (8)	213.0 (23)	228.0 (25)	171.0 (19)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
MIADC*R1	710.3	.0 (0)	.0 (0)	.0 (0)	81.0 (11)	63.0 (8)	129.0 (18)
MIADT*R1	905.9	.0 (0)	3.0 (0)	.0 (0)	15.0 (1)	15.0 (1)	15.0 (1)
MIAE*RR1	859.8	75.0 (8)	75.0 (8)	180.0 (20)	375.0 (43)	327.0 (38)	369.0 (42)
MIAIADR1	710.3	.0 (0)	.0 (0)	.0 (0)	81.0 (11)	63.0 (8)	129.0 (18)
MIAIA*R1	755.0	162.0 (21)	174.0 (23)	162.0 (21)	237.0 (31)	249.0 (32)	228.0 (30)
MIAL*RR1	859.8	75.0 (8)	75.0 (8)	180.0 (20)	375.0 (43)	327.0 (38)	369.0 (42)
MIALA*R1	1923.7	162.0 (8)	174.0 (9)	162.0 (8)	300.0 (15)	288.0 (14)	306.0 (15)
MIALG*R1	859.8	75.0 (8)	75.0 (8)	180.0 (20)	375.0 (43)	327.0 (38)	369.0 (42)
MIAM*YR1	506.8	78.0 (15)	108.0 (21)	78.0 (15)	195.0 (38)	189.0 (37)	153.0 (30)
MIAP*LR1	795.0	39.0 (4)	39.0 (4)	69.0 (8)	210.0 (26)	165.0 (20)	273.0 (34)
MIAPITR1	793.3	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)	15.0 (1)
MIAS*RR1	2138.0	90.0 (4)	120.0 (5)	126.0 (5)	327.0 (15)	324.0 (15)	273.0 (12)
MIASYLR1	841.1	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	24.0 (2)	9.0 (1)
MKCC*SR1	382.0	.0 (0)	.0 (0)	.0 (0)	18.0 (4)	18.0 (4)	18.0 (4)
MKCDENR1	394.2	.0 (0)	.0 (0)	.0 (0)	24.0 (6)	30.0 (7)	15.0 (3)
MKCE*RR1	860.1	.0 (0)	.0 (0)	.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
MKCICTR1	76.0	.0 (0)	.0 (0)	.0 (0)	21.0 (27)	21.0 (27)	21.0 (27)
MKCLA*R1	1076.9	.0 (0)	.0 (0)	.0 (0)	27.0 (2)	36.0 (3)	27.0 (2)
MKCLG*R1	860.1	.0 (0)	.0 (0)	.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
MKCSF*R1	1194.2	6.0 (0)	21.0 (1)	12.0 (1)	129.0 (10)	120.0 (10)	120.0 (10)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
MKCSTLR1	118.1	.0 (0)	.0 (0)	.0 (0)	21.0 (17)	21.0 (17)	21.0 (17)
MKECEAR1	699.6	.0 (0)	.0 (0)	.0 (0)	30.0 (4)	30.0 (4)	30.0 (4)
MKECETR1	119.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (2)	.0 (0)
MKECTWR1	119.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (2)	.0 (0)
MKEMSBR1	170.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (3)
MSPCCAR1	706.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	21.0 (2)	9.0 (1)
MSPCENR1	510.8	.0 (0)	.0 (0)	.0 (0)	57.0 (11)	57.0 (11)	69.0 (13)
MSPCTWR1	371.4	.0 (0)	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	9.0 (2)
MSPWFKR1	794.7	.0 (0)	.0 (0)	.0 (0)	42.0 (5)	42.0 (5)	135.0 (16)
MSPLAXR1	1230.6	.0 (0)	.0 (0)	6.0 (0)	213.0 (17)	213.0 (17)	222.0 (18)
MSPLGAR1	794.7	.0 (0)	.0 (0)	.0 (0)	42.0 (5)	42.0 (5)	135.0 (16)
MSPMKER1	168.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	.0 (0)
MSPSEAR1	1131.2	.0 (0)	.0 (0)	.0 (0)	282.0 (24)	255.0 (22)	309.0 (27)
MSPSFOR1	1274.8	57.0 (4)	57.0 (4)	60.0 (4)	198.0 (15)	270.0 (21)	180.0 (14)
MSYABQR1	793.6	.0 (0)	.0 (0)	.0 (0)	102.0 (12)	99.0 (12)	114.0 (14)
MSYATLR1	288.7	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	.0 (0)	12.0 (4)
MSYBALR1	747.8	.0 (0)	.0 (0)	.0 (0)	51.0 (6)	66.0 (8)	33.0 (4)
MSYCALR1	299.8	.0 (0)	.0 (0)	.0 (0)	12.0 (4)	33.0 (11)	18.0 (6)
MSYIACR1	747.8	.0 (0)	.0 (0)	.0 (0)	51.0 (6)	66.0 (8)	33.0 (4)
MSYIAHR1	176.7	.0 (0)	.0 (0)	.0 (0)	42.0 (23)	42.0 (23)	30.0 (16)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE		LEFT-OS COVERAGE		NO RIGHT-OS COVERAGE		ROUTE WIDTH >(SP)		LEFT-OS >(SP)		RIGHT-OS >(SP)	
		MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)	MILES	(%)
MSYLFNR1	929.8	.0	(0)	.0	(0)	.0	(0)	51.0	(5)	66.0	(7)	33.0	(3)
MSYLANR1	1337.1	.0	(0)	21.0	(1)	12.0	(0)	111.0	(8)	99.0	(7)	114.0	(8)
MSYMINR1	498.2	78.0	(15)	78.0	(15)	108.0	(21)	180.0	(36)	141.0	(28)	195.0	(39)
MSYORCR1	624.9	.0	(0)	.0	(0)	.0	(0)	3.0	(0)	3.0	(0)	3.0	(0)
MSYTFNR1	336.2	.0	(0)	.0	(0)	45.0	(13)	201.0	(59)	162.0	(48)	204.0	(60)
OAKLFNR1	2130.4	.0	(0)	18.0	(0)	18.0	(0)	171.0	(8)	300.0	(14)	171.0	(8)
OAKLANR1	248.6	.0	(0)	24.0	(9)	12.0	(4)	27.0	(10)	12.0	(4)	15.0	(6)
OAKORCR1	1481.6	.0	(0)	3.0	(0)	.0	(0)	165.0	(11)	171.0	(11)	156.0	(10)
OAKFCNR1	378.9	.0	(0)	.0	(0)	.0	(0)	21.0	(5)	21.0	(5)	21.0	(5)
OAKRNCR1	57.8	.0	(0)	.0	(0)	.0	(0)	6.0	(10)	6.0	(10)	.0	(0)
OAKSEAR1	486.9	.0	(0)	.0	(0)	.0	(0)	21.0	(4)	21.0	(4)	21.0	(4)
OKCLANR1	228.2	.0	(0)	3.0	(0)	.0	(0)	.0	(0)	3.0	(0)	3.0	(0)
OKCORCR1	499.8	.0	(0)	.0	(0)	.0	(0)	33.0	(6)	15.0	(3)	39.0	(7)
OMABALR1	774.1	.0	(0)	.0	(0)	.0	(0)	21.0	(2)	21.0	(2)	33.0	(4)
OMACENR1	336.6	.0	(0)	.0	(0)	.0	(0)	24.0	(7)	15.0	(4)	24.0	(7)
OMAIACR1	774.1	.0	(0)	.0	(0)	.0	(0)	21.0	(2)	21.0	(2)	33.0	(4)
OMALANR1	1056.6	.0	(0)	3.0	(0)	51.0	(4)	171.0	(16)	165.0	(15)	153.0	(14)
ONTERCR1	1388.9	.0	(0)	.0	(0)	30.0	(2)	36.0	(2)	45.0	(3)	36.0	(2)
ORDABCR1	869.7	.0	(0)	.0	(0)	.0	(0)	36.0	(4)	27.0	(3)	45.0	(5)
ORDBALR1	418.6	.0	(0)	.0	(0)	.0	(0)	33.0	(7)	33.0	(7)	33.0	(7)

ROUTE ID	ROUTE MILES	NE ROUTE COVERAGE	NE LEFT-OS COVERAGE	NE RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
CRDBCSR1	671.8	.C (C)	.C (C)	.C (C)	15.C (2)	15.C (2)	3.C (C)
CRDBLBR1	309.9	.C (C)	.C (C)	.C (C)	.C (C)	12.C (3)	.C (C)
CRDCLTR1	422.8	.C (C)	.C (C)	.C (C)	30.C (7)	27.C (6)	30.C (7)
CRDDALR1	601.5	.C (C)	.C (C)	.C (C)	69.C (11)	60.C (9)	69.C (11)
CRDDCAR1	418.6	.C (C)	.C (C)	.C (C)	33.C (7)	33.C (7)	33.C (7)
CRDDEAR1	679.9	.C (C)	.C (C)	.C (C)	21.C (3)	21.C (3)	27.C (3)
CRDEWBR1	519.4	.C (C)	.C (C)	.C (C)	.C (C)	3.C (C)	3.C (C)
CRDGSCR1	408.9	.C (C)	.C (C)	.C (C)	24.C (5)	15.C (3)	24.C (5)
CRDHCLR1	679.7	.C (C)	.C (C)	.C (C)	3.C (C)	3.C (C)	9.C (1)
CRDIADR1	418.6	.C (C)	.C (C)	.C (C)	33.C (7)	33.C (7)	33.C (7)
CRDIAWR1	679.7	.C (C)	.C (C)	.C (C)	3.C (C)	3.C (C)	9.C (1)
CRDICTR1	424.7	.C (C)	.C (C)	.C (C)	42.C (9)	39.C (9)	42.C (9)
CRDLFWR1	519.4	.C (C)	.C (C)	.C (C)	.C (C)	3.C (C)	3.C (C)
CRDLASR1	1222.9	2.C (1)	35.C (3)	42.C (3)	57.C (4)	57.C (4)	60.C (4)
CRDLAWR1	1396.6	.C (C)	30.C (2)	.C (C)	36.C (2)	36.C (2)	45.C (3)
CRDLAWR2	1399.5	.C (C)	3.C (C)	.C (C)	39.C (2)	33.C (2)	39.C (2)
CRDLGAR1	519.4	.C (C)	.C (C)	.C (C)	.C (C)	3.C (C)	3.C (C)
CRDMBYR1	628.6	.C (C)	.C (C)	.C (C)	3.C (C)	3.C (C)	3.C (C)
CRDOAKR1	1486.2	.C (C)	9.C (C)	21.C (1)	177.C (11)	177.C (11)	306.C (20)
CRDOKCR1	503.3	.C (C)	.C (C)	.C (C)	33.C (6)	39.C (7)	15.C (2)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-CS COVERAGE	NO RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
CRCENTR1	1396.6	.0 (0)	30.0 (2)	.0 (0)	36.0 (2)	36.0 (2)	45.0 (3)
CRCFCNR1	1411.7	6.0 (0)	39.0 (2)	24.0 (1)	183.0 (12)	288.0 (20)	156.0 (11)
CRCFMNR1	1149.7	.0 (0)	.0 (0)	18.0 (1)	18.0 (1)	30.0 (2)	15.0 (1)
CRCRCLR1	459.1	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	9.0 (1)
CRCRCCR1	357.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	12.0 (3)	.0 (0)
CRCSANR1	1397.0	.0 (0)	.0 (0)	.0 (0)	417.0 (29)	408.0 (29)	417.0 (29)
CRCSER1	1397.6	.0 (0)	.0 (0)	.0 (0)	471.0 (33)	471.0 (33)	462.0 (33)
CRCSFCR1	1486.2	.0 (0)	9.0 (0)	21.0 (1)	177.0 (11)	177.0 (11)	306.0 (20)
CRCSFCR2	1493.3	.0 (0)	.0 (0)	12.0 (0)	111.0 (7)	111.0 (7)	114.0 (7)
CRCSFCR3	1495.1	24.0 (1)	54.0 (3)	84.0 (5)	246.0 (16)	222.0 (14)	213.0 (14)
CRCSLCR1	1486.2	.0 (0)	9.0 (0)	21.0 (1)	177.0 (11)	177.0 (11)	306.0 (20)
CRCSLCR1	989.2	6.0 (0)	3.0 (0)	81.0 (8)	99.0 (10)	102.0 (10)	141.0 (14)
CRCSYRR1	427.3	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	21.0 (4)	9.0 (2)
CRCTFAR1	774.5	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	3.0 (0)	48.0 (6)
CRCTLLR1	411.4	.0 (0)	.0 (0)	.0 (0)	33.0 (8)	33.0 (8)	15.0 (3)
CRCTLSR1	1147.5	.0 (0)	.0 (0)	.0 (0)	36.0 (3)	30.0 (2)	48.0 (4)
CRFLFNR1	165.4	.0 (0)	.0 (0)	.0 (0)	45.0 (27)	27.0 (16)	45.0 (27)
CRFLGAR1	165.4	.0 (0)	.0 (0)	.0 (0)	45.0 (27)	27.0 (16)	45.0 (27)
FBILFNR1	792.5	39.0 (4)	39.0 (4)	69.0 (8)	249.0 (31)	192.0 (24)	303.0 (38)
FBILGAR1	792.5	39.0 (4)	39.0 (4)	69.0 (8)	249.0 (31)	192.0 (24)	303.0 (38)

ROUTE ID	ROUTE MILES	NB ROUTE COVERAGE	NB LEFT-ES COVERAGE	NB RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-SE >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
FDXBGIR1	213.8	.0 (0)	.0 (0)	.0 (0)	42.0 (19)	51.0 (23)	33.0 (15)
FDXDENR1	768.6	.0 (0)	15.0 (1)	15.0 (1)	168.0 (21)	186.0 (24)	168.0 (21)
FDXLAXR1	63.7	.0 (0)	3.0 (0)	6.0 (0)	216.0 (34)	213.0 (33)	216.0 (34)
FDXSANR1	378.0	.0 (0)	.0 (0)	.0 (0)	24.0 (6)	24.0 (6)	24.0 (6)
FDXSFOR1	1422.8	6.0 (0)	24.0 (1)	39.0 (2)	183.0 (12)	156.0 (10)	288.0 (20)
FDXSFOR1	378.0	.0 (0)	.0 (0)	.0 (0)	24.0 (6)	24.0 (6)	24.0 (6)
FDXSLCR1	378.0	.0 (0)	.0 (0)	.0 (0)	24.0 (6)	24.0 (6)	24.0 (6)
FDXSLCR1	466.1	.0 (0)	.0 (0)	15.0 (3)	102.0 (21)	102.0 (21)	75.0 (16)
FHLATLR1	491.6	.0 (0)	.0 (0)	.0 (0)	21.0 (4)	30.0 (6)	36.0 (7)
FHLBNAR1	499.7	.0 (0)	.0 (0)	.0 (0)	75.0 (15)	75.0 (15)	78.0 (15)
FHLCLTR1	308.0	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	9.0 (2)	18.0 (5)
FHLFLLR1	791.9	39.0 (4)	69.0 (8)	39.0 (4)	213.0 (26)	345.0 (43)	168.0 (21)
FHLLAXR1	1983.7	.0 (0)	.0 (0)	.0 (0)	33.0 (1)	51.0 (2)	33.0 (1)
FHLMIAR1	791.9	39.0 (4)	69.0 (8)	39.0 (4)	213.0 (26)	345.0 (43)	168.0 (21)
FHLSFOR1	2093.6	.0 (0)	9.0 (0)	18.0 (0)	150.0 (7)	141.0 (6)	156.0 (7)
FHLSTLR1	618.1	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)
FHXABQR1	200.7	.0 (0)	.0 (0)	.0 (0)	9.0 (4)	9.0 (4)	9.0 (4)
FHXCALR1	665.8	.0 (0)	.0 (0)	18.0 (2)	96.0 (14)	90.0 (13)	78.0 (11)
FHXDENR1	423.1	.0 (0)	15.0 (3)	3.0 (0)	48.0 (11)	36.0 (8)	48.0 (11)
FHXELPR1	216.3	.0 (0)	.0 (0)	.0 (0)	18.0 (8)	30.0 (13)	18.0 (8)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-PS COVERAGE MILES (%)	NO RIGHT-PS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-PS >(SP) MILES (%)	RIGHT-PS >(SP) MILES (%)
FHXIAHR1	793.9	.0 (0)	.0 (0)	.0 (0)	42.0 (5)	72.0 (9)	42.0 (5)
FHX_FHR1	1781.7	.0 (0)	.0 (0)	.0 (0)	72.0 (4)	75.0 (4)	114.0 (6)
FHXLASR1	135.4	.0 (0)	6.0 (4)	.0 (0)	3.0 (2)	3.0 (2)	12.0 (8)
FHXLAXR1	204.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)
FHXMDWR1	1153.3	.0 (0)	18.0 (1)	.0 (0)	18.0 (1)	15.0 (1)	18.0 (1)
FHXONTR1	204.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)
FHXORCR1	1153.3	.0 (0)	18.0 (1)	.0 (0)	18.0 (1)	15.0 (1)	18.0 (1)
FHXSFOR1	452.7	.0 (0)	.0 (0)	6.0 (1)	15.0 (3)	12.0 (2)	36.0 (7)
FHXSNAR1	204.7	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)
FHXSTLR1	1010.6	.0 (0)	.0 (0)	.0 (0)	72.0 (7)	66.0 (6)	117.0 (11)
FITATLR1	366.7	.0 (0)	.0 (0)	12.0 (3)	57.0 (15)	57.0 (15)	48.0 (13)
FITBCLR1	263.6	.0 (0)	.0 (0)	.0 (0)	21.0 (7)	21.0 (7)	21.0 (7)
FITBNAR1	314.9	.0 (0)	.0 (0)	.0 (0)	48.0 (15)	57.0 (18)	57.0 (18)
FITBOSR1	348.3	.0 (0)	.0 (0)	.0 (0)	21.0 (6)	21.0 (6)	21.0 (6)
FITCLTR1	232.2	.0 (0)	.0 (0)	.0 (0)	15.0 (6)	15.0 (6)	6.0 (2)
FITE_SR1	180.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	.0 (0)
FITFLLR1	792.6	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	21.0 (2)	6.0 (0)
FIT_FAR1	180.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	.0 (0)
FITLCAR1	180.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	.0 (0)
FITMIAR1	792.6	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	21.0 (2)	6.0 (0)

ROUTE ID	ROUTE MILES	NB ROUTE COVERAGE	NB LEFT-PS COVERAGE	NB RIGHT-PS COVERAGE	ROUTE WIDTH >(SP)	LEFT-PS >(SP)	RIGHT-PS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
PITSCPR1	202.7	.0 (0)	.0 (0)	.0 (0)	48.0 (23)	48.0 (23)	42.0 (20)
PNSATLR1	147.3	.0 (0)	.0 (0)	.0 (0)	.0 (0)	15.0 (10)	.0 (0)
RDLATLR1	220.5	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	.0 (0)	12.0 (5)
RDLCRCR1	461.1	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	9.0 (1)
RNCLASR1	214.2	.0 (0)	45.0 (21)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
RSCCRCR1	362.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)
SANJFKR1	2014.5	.0 (0)	.0 (0)	3.0 (0)	39.0 (1)	36.0 (1)	24.0 (1)
SANCRCR1	1392.8	.0 (0)	.0 (0)	.0 (0)	417.0 (29)	417.0 (29)	408.0 (29)
SATLERR1	342.9	.0 (0)	.0 (0)	.0 (0)	72.0 (20)	81.0 (23)	72.0 (20)
SATLAXR1	936.8	.0 (0)	.0 (0)	.0 (0)	72.0 (7)	84.0 (8)	72.0 (7)
SCFCCAR1	308.8	.0 (0)	.0 (0)	.0 (0)	108.0 (34)	75.0 (24)	114.0 (36)
SCFLGAR1	484.7	.0 (0)	.0 (0)	.0 (0)	45.0 (9)	54.0 (11)	45.0 (9)
SCFMEMR1	188.4	.0 (0)	.0 (0)	.0 (0)	78.0 (41)	66.0 (35)	75.0 (39)
SCFFITR1	203.9	.0 (0)	.0 (0)	.0 (0)	30.0 (14)	30.0 (14)	39.0 (19)
SEABALR1	1920.6	.0 (0)	15.0 (0)	.0 (0)	267.0 (13)	315.0 (16)	249.0 (12)
SEACENR1	800.9	.0 (0)	39.0 (4)	60.0 (7)	222.0 (27)	225.0 (28)	222.0 (27)
SEAIADR1	1920.6	.0 (0)	15.0 (0)	.0 (0)	267.0 (13)	315.0 (16)	249.0 (12)
SEALFKR1	2001.5	.0 (0)	18.0 (0)	3.0 (0)	708.0 (35)	780.0 (38)	648.0 (32)
SEALAXR1	735.9	.0 (0)	3.0 (0)	6.0 (0)	216.0 (29)	213.0 (28)	216.0 (29)
SEAMSPR1	1126.5	.0 (0)	15.0 (1)	.0 (0)	267.0 (23)	294.0 (26)	240.0 (21)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE	NO LEFT-ES COVERAGE	NO RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SEACAKR1	487.8	.0 (0)	.0 (0)	.0 (0)	24.0 (4)	24.0 (4)	24.0 (4)
SEACRDR1	1399.4	.0 (0)	.0 (0)	15.0 (1)	222.0 (15)	228.0 (16)	246.0 (17)
SEASPER1	487.8	.0 (0)	.0 (0)	.0 (0)	24.0 (4)	24.0 (4)	24.0 (4)
SEAS_CR1	487.8	.0 (0)	.0 (0)	.0 (0)	24.0 (4)	24.0 (4)	24.0 (4)
SFCAEGR1	666.0	18.0 (1)	48.0 (7)	12.0 (1)	24.0 (3)	6.0 (0)	30.0 (4)
SFCATLR1	1750.4	.0 (0)	6.0 (0)	12.0 (0)	273.0 (15)	294.0 (16)	282.0 (16)
SFCBCIR1	348.2	48.0 (13)	42.0 (12)	54.0 (15)	42.0 (12)	51.0 (14)	36.0 (10)
SFCBCSR1	2248.9	345.0 (15)	414.0 (18)	396.0 (17)	615.0 (27)	699.0 (31)	435.0 (19)
SFCCAL1	1159.6	18.0 (1)	48.0 (4)	12.0 (1)	75.0 (6)	66.0 (5)	90.0 (7)
SFCDEN1	729.4	18.0 (1)	18.0 (2)	9.0 (1)	102.0 (13)	102.0 (13)	96.0 (13)
SFCDTAR1	1698.5	.0 (0)	3.0 (0)	.0 (0)	165.0 (9)	171.0 (10)	156.0 (9)
SFCEWRR1	2130.4	.0 (0)	18.0 (0)	18.0 (0)	171.0 (8)	300.0 (14)	171.0 (8)
SFCGEGR1	535.8	.0 (0)	6.0 (1)	6.0 (1)	189.0 (35)	186.0 (34)	192.0 (35)
SFCIACR1	2002.1	.0 (0)	3.0 (0)	21.0 (1)	165.0 (8)	162.0 (8)	138.0 (6)
SFCIAHR1	1307.5	.0 (0)	24.0 (1)	12.0 (0)	123.0 (9)	99.0 (7)	108.0 (8)
SFC_FWR1	2130.4	.0 (0)	18.0 (0)	18.0 (0)	171.0 (8)	300.0 (14)	171.0 (8)
SFC_FWR2	2119.7	.0 (0)	3.0 (0)	.0 (0)	132.0 (6)	138.0 (6)	132.0 (6)
SFC_FWR3	2138.6	24.0 (1)	87.0 (4)	60.0 (2)	261.0 (12)	231.0 (10)	237.0 (11)
SFCLASR1	248.6	.0 (0)	24.0 (9)	12.0 (4)	27.0 (10)	12.0 (4)	15.0 (6)
SFCLGAR1	2130.4	.0 (0)	18.0 (0)	18.0 (0)	171.0 (8)	300.0 (14)	171.0 (8)

ROUTE ID	ROUTE MILES	NB ROUTE COVERAGE	NB LEFT-ES COVERAGE	NB RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SFCMDAR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	165.0 (11)	171.0 (11)	156.0 (10)
SFCMIAR1	2132.4	90.0 (4)	126.0 (5)	120.0 (5)	315.0 (14)	261.0 (12)	333.0 (15)
SFCMKCR1	1194.9	6.0 (0)	3.0 (0)	24.0 (2)	135.0 (11)	126.0 (10)	126.0 (10)
SFCMSFR1	1278.1	57.0 (4)	60.0 (4)	54.0 (4)	177.0 (13)	159.0 (12)	249.0 (19)
SFCORDR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	165.0 (11)	171.0 (11)	156.0 (10)
SFCORDR2	1482.2	.0 (0)	18.0 (1)	18.0 (1)	171.0 (11)	300.0 (20)	171.0 (11)
SFCPDXR1	378.9	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	21.0 (5)	21.0 (5)
SFCPWLR1	2090.8	.0 (0)	3.0 (0)	.0 (0)	165.0 (7)	171.0 (8)	156.0 (7)
SFCPWXR1	457.6	.0 (0)	6.0 (1)	.0 (0)	.0 (0)	12.0 (2)	.0 (0)
SFCRNCR1	57.8	.0 (0)	.0 (0)	.0 (0)	6.0 (10)	6.0 (10)	.0 (0)
SFCSEAR1	488.9	.0 (0)	.0 (0)	.0 (0)	21.0 (4)	21.0 (4)	21.0 (4)
SFCSLCR1	415.7	21.0 (5)	66.0 (15)	30.0 (7)	87.0 (20)	78.0 (18)	87.0 (20)
SFCSTLR1	1403.3	6.0 (0)	3.0 (0)	24.0 (1)	165.0 (11)	147.0 (10)	153.0 (10)
SHVWAN1	101.3	.0 (0)	.0 (0)	.0 (0)	27.0 (26)	27.0 (26)	36.0 (35)
SHVMEMR1	160.3	.0 (0)	.0 (0)	.0 (0)	18.0 (11)	27.0 (16)	18.0 (11)
SWCDENR1	729.4	12.0 (1)	18.0 (2)	9.0 (1)	102.0 (13)	102.0 (13)	96.0 (13)
SWCWFKR1	2130.4	.0 (0)	18.0 (0)	18.0 (0)	171.0 (8)	300.0 (14)	171.0 (8)
SWCLASR1	248.6	.0 (0)	24.0 (9)	12.0 (4)	27.0 (10)	12.0 (4)	15.0 (6)
SWCORDR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	165.0 (11)	171.0 (11)	156.0 (10)
SWCPDXR1	378.9	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	21.0 (5)	21.0 (5)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SLCSEAR1	488.9	.0 (0)	.0 (0)	.0 (0)	21.0 (4)	21.0 (4)	21.0 (4)
SLCBCIR1	166.8	.0 (0)	.0 (0)	.0 (0)	54.0 (32)	54.0 (32)	54.0 (32)
SLCCENR1	244.2	.0 (0)	.0 (0)	.0 (0)	48.0 (19)	48.0 (19)	48.0 (19)
SLCLASR1	233.3	.0 (0)	.0 (0)	.0 (0)	54.0 (23)	54.0 (23)	54.0 (23)
SLCLAXR1	412.4	.0 (0)	.0 (0)	.0 (0)	30.0 (7)	30.0 (7)	42.0 (10)
SLCERCR1	986.4	6.0 (0)	78.0 (7)	3.0 (0)	96.0 (9)	138.0 (13)	99.0 (10)
SLCPCXR1	461.3	.0 (0)	15.0 (3)	.0 (0)	102.0 (22)	75.0 (16)	102.0 (22)
SLCSFCR1	411.9	21.0 (5)	24.0 (5)	63.0 (15)	75.0 (18)	75.0 (18)	66.0 (16)
STLATLR1	333.0	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (1)
STLBALR1	526.3	.0 (0)	.0 (0)	.0 (0)	39.0 (7)	39.0 (7)	42.0 (7)
STLBCSR1	824.0	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
STLCALR1	397.8	.0 (0)	.0 (0)	.0 (0)	63.0 (15)	42.0 (10)	69.0 (17)
STLCCAR1	526.3	.0 (0)	.0 (0)	.0 (0)	39.0 (7)	39.0 (7)	42.0 (7)
STLCENR1	599.8	.0 (0)	.0 (0)	.0 (0)	33.0 (5)	39.0 (6)	24.0 (4)
STLEXRR1	689.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)
STLIACR1	526.3	.0 (0)	.0 (0)	.0 (0)	39.0 (7)	39.0 (7)	42.0 (7)
STLIAHR1	493.9	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	9.0 (1)
STLLFKR1	689.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)
STLLAXR1	1272.6	.0 (0)	3.0 (0)	.0 (0)	102.0 (8)	132.0 (10)	72.0 (5)
STLLCAR1	689.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)

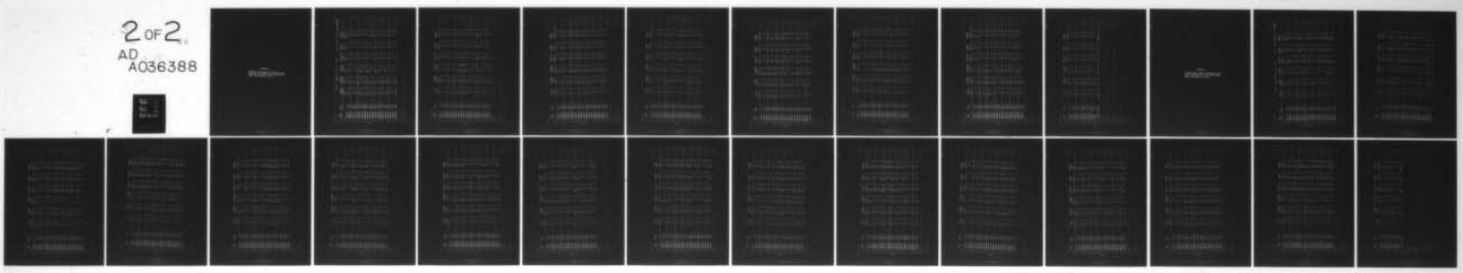
ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-ES COVERAGE MILES (%)	NO RIGHT-ES COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-ES >(SP) MILES (%)	RIGHT-ES >(SP) MILES (%)
STLMIAR1	839.9	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	9.0 (1)	24.0 (2)
STLMKCR1	118.4	.0 (0)	.0 (0)	.0 (0)	9.0 (7)	18.0 (15)	9.0 (7)
STLPHLR1	625.9	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (1)
STLPHXR1	1007.4	.0 (0)	.0 (0)	.0 (0)	72.0 (7)	105.0 (10)	63.0 (6)
STLSFOR1	1399.8	6.0 (0)	21.0 (1)	12.0 (0)	138.0 (9)	129.0 (9)	129.0 (9)
STLTULR1	218.1	.0 (0)	.0 (0)	.0 (0)	39.0 (17)	39.0 (17)	48.0 (22)
SYRCTAR1	237.9	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	6.0 (2)	15.0 (6)
SYRERCR1	428.6	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	6.0 (1)	15.0 (3)
TEBCLER1	259.8	.0 (0)	9.0 (3)	.0 (0)	3.0 (1)	3.0 (1)	3.0 (1)
TEBGSCR1	296.9	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	18.0 (6)	9.0 (3)
TPAATLR1	265.5	.0 (0)	.0 (0)	.0 (0)	12.0 (4)	27.0 (10)	3.0 (1)
TPACLER1	718.7	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	21.0 (2)	3.0 (0)
TPACTAR1	766.2	.0 (0)	.0 (0)	.0 (0)	45.0 (5)	54.0 (7)	36.0 (4)
TPAEXAR1	769.2	.0 (0)	.0 (0)	.0 (0)	33.0 (4)	24.0 (3)	60.0 (7)
TPALPKR1	769.2	.0 (0)	.0 (0)	.0 (0)	33.0 (4)	24.0 (3)	60.0 (7)
TPAMSYR1	340.2	.0 (0)	45.0 (13)	.0 (0)	210.0 (61)	213.0 (62)	168.0 (49)
TPASCCR1	776.7	.0 (0)	.0 (0)	.0 (0)	12.0 (1)	27.0 (3)	3.0 (0)
TULMKCR1	104.2	.0 (0)	.0 (0)	.0 (0)	.0 (0)	21.0 (20)	6.0 (5)
TULSRCR1	407.0	.0 (0)	.0 (0)	.0 (0)	33.0 (8)	15.0 (3)	33.0 (8)
TULSTLR1	215.4	.0 (0)	.0 (0)	.0 (0)	54.0 (25)	54.0 (25)	42.0 (19)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-ES COVERAGE MILES (%)	NO RIGHT-ES COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-ES >(SP) MILES (%)	RIGHT-ES >(SP) MILES (%)
TLSAEL-1	193.3	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	3.0 (1)
TLSELP-1	143.8	.0 (0)	.0 (0)	.0 (0)	12.0 (8)	12.0 (8)	3.0 (2)
TLSERC-1	1157.2	.0 (0)	.0 (0)	.0 (0)	36.0 (3)	48.0 (4)	30.0 (2)
TYSCCAR1	280.2	.0 (0)	16.0 (6)	.0 (0)	66.0 (23)	69.0 (24)	66.0 (23)
TOTAL	490711.5	4786.0 (0)	7233.0 (1)	7641.0 (1)	48919.8 (10)	52109.8 (10)	51428.8 (10)

AD-A036 388 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 17/7
NAVAID SUPPORT OF HIGH-ALTITUDE AREA NAVIGATION ROUTES.(U)
FEB 77 A G HALVERSON, F B WOODSON

UNCLASSIFIED FAA-NA-76-49 FAA/RD-76-210 NL

2 OF 2
AD
A036388



END

DATE
FILMED
3-77

APPENDIX B

PROBLEM ROUTE SUMMARY, HYPOTHETICAL RNAV STRUCTURE, RNAV TASK FORCE CROSS-COURSE ERROR, ROUTE WIDTH = $\pm$4 NMI

****** PROBLEM ROUTE SUMMARY ****** (SP)= 4.0 MILES ; OFFSET DIST. = 8.0MILES

ROUTE ID	ROUTE MILES	NC ROUTE COVERAGE MILES (%)	NC LEFT-OS COVERAGE MILES (%)	NC RIGHT-OS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-OS >(SP) MILES (%)	RIGHT-OS >(SP) MILES (%)
ABGMIAR1	1374.5	78.0 (5)	78.0 (5)	108.0 (7)	21.0 (1)	21.0 (1)	15.0 (1)
ABGSFCR1	671.0	12.0 (1)	12.0 (1)	33.0 (4)	.0 (0)	.0 (0)	.0 (0)
ATLSFCR1	1754.9	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
BALLAXR1	1885.9	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
BCLMIAR1	950.9	75.0 (7)	150.0 (15)	75.0 (7)	.0 (0)	.0 (0)	.0 (0)
BCISFCR1	348.9	48.0 (13)	54.0 (15)	36.0 (10)	.0 (0)	.0 (0)	.0 (0)
BCSFLLR1	1018.2	192.0 (18)	219.0 (21)	192.0 (18)	.0 (0)	.0 (0)	.0 (0)
BCSLAXR1	2162.0	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
BCSMIAR1	1018.2	192.0 (18)	219.0 (21)	192.0 (18)	.0 (0)	.0 (0)	.0 (0)
BCSSFCR1	2243.6	315.0 (14)	321.0 (14)	363.0 (16)	.0 (0)	.0 (0)	.0 (0)
CLELAXR1	1680.6	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CALMIAR1	888.9	78.0 (8)	78.0 (8)	108.0 (12)	21.0 (2)	21.0 (2)	15.0 (1)
CALSFCR1	1162.4	12.0 (1)	12.0 (1)	33.0 (2)	.0 (0)	.0 (0)	.0 (0)
CENBCIR1	474.9	.0 (0)	9.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CENLASR1	446.3	24.0 (5)	24.0 (5)	30.0 (6)	.0 (0)	.0 (0)	.0 (0)
CENLAXR1	632.4	6.0 (0)	18.0 (2)	33.0 (5)	.0 (0)	.0 (0)	.0 (0)
CENFCXR1	770.1	.0 (0)	9.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CENFPXR1	426.0	.0 (0)	.0 (0)	6.0 (1)	.0 (0)	.0 (0)	.0 (0)
CENSEAR1	798.1	.0 (0)	9.0 (1)	9.0 (1)	.0 (0)	.0 (0)	.0 (0)
CENSFCR1	721.4	3.0 (0)	21.0 (2)	.0 (0)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	NB ROUTE COVERAGE	NB LEFT-OS COVERAGE	NB RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
CENSUS1	721.4	3.0 (0)	21.0 (2)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CSPLAN1	1155.6	.0 (0)	3.0 (0)	39.0 (3)	.0 (0)	.0 (0)	.0 (0)
CTHLAN1	1616.1	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
EWRFLL1	847.3	75.0 (8)	150.0 (17)	75.0 (8)	.0 (0)	.0 (0)	.0 (0)
EWRLAN2	2031.0	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
EWRMIA1	847.0	39.0 (4)	65.0 (8)	39.0 (4)	.0 (0)	.0 (0)	.0 (0)
EWRSFO1	2123.0	.0 (0)	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)
FLLBOS1	1020.5	177.0 (17)	177.0 (17)	213.0 (20)	.0 (0)	.0 (0)	.0 (0)
FLLEWR1	858.8	75.0 (8)	75.0 (8)	192.0 (22)	.0 (0)	.0 (0)	.0 (0)
FLLJFK1	858.8	75.0 (8)	75.0 (8)	192.0 (22)	.0 (0)	.0 (0)	.0 (0)
FLLPHL1	795.0	39.0 (4)	39.0 (4)	69.0 (8)	.0 (0)	.0 (0)	.0 (0)
GEGSFO1	536.5	.0 (0)	18.0 (3)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
IADLAN1	1885.9	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
IADSFO1	1999.7	.0 (0)	18.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
IAHMIA1	748.9	162.0 (21)	162.0 (21)	177.0 (23)	36.0 (4)	36.0 (4)	24.0 (3)
IAHSFO1	1312.4	.0 (0)	12.0 (0)	15.0 (1)	.0 (0)	.0 (0)	.0 (0)
JFKFLL1	847.3	75.0 (8)	150.0 (17)	75.0 (8)	.0 (0)	.0 (0)	.0 (0)
JFKLAS1	1846.7	.0 (0)	3.0 (0)	6.0 (0)	.0 (0)	.0 (0)	.0 (0)
JFKLAX2	2031.0	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
JFKMIA1	847.3	75.0 (8)	150.0 (17)	75.0 (8)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-OS COVERAGE MILES (%)	NO RIGHT-OS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-OS >(SP) MILES (%)	RIGHT-OS >(SP) MILES (%)
_FKCAKR1	2123.0	.0 (0)	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)
_FKPBIR1	791.0	39.0 (4)	69.0 (8)	39.0 (4)	.0 (0)	.0 (0)	.0 (0)
_FKEEAR1	1998.5	.0 (0)	3.0 (0)	9.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
_FKSFR1	2123.0	.0 (0)	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)
_FKSFR2	2125.3	.0 (0)	18.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
_FKSFR3	2141.1	24.0 (1)	42.0 (1)	63.0 (2)	.0 (0)	.0 (0)	.0 (0)
_FKS_CR1	2123.0	.0 (0)	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)
LASCEAR1	452.2	6.0 (1)	45.0 (9)	24.0 (5)	.0 (0)	.0 (0)	.0 (0)
LAS_FER1	1841.7	.0 (0)	6.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LASCAKR1	252.2	.0 (0)	12.0 (4)	15.0 (5)	.0 (0)	.0 (0)	.0 (0)
LASCFCR1	1220.1	6.0 (1)	30.0 (2)	24.0 (1)	.0 (0)	.0 (0)	.0 (0)
LASFAER1	210.8	.0 (0)	3.0 (1)	12.0 (5)	.0 (0)	.0 (0)	.0 (0)
LASSFCR1	252.2	.0 (0)	12.0 (4)	15.0 (5)	.0 (0)	.0 (0)	.0 (0)
LASS_CR1	252.2	.0 (0)	12.0 (4)	15.0 (5)	.0 (0)	.0 (0)	.0 (0)
LAXBALR1	1883.7	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXBCSR1	2162.5	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXCLER1	1674.3	.0 (0)	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXCEAR1	629.9	.0 (0)	33.0 (5)	9.0 (1)	.0 (0)	.0 (0)	.0 (0)
LAXCSAR1	1152.8	.0 (0)	39.0 (3)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXCTAR1	1612.5	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE	LEFT-DS COVERAGE	RIGHT-DS COVERAGE	ROUTE WIDTH >(SP)	LEFT-DS >(SP)	RIGHT-DS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
LAXEARR2	2046.3	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXIADR1	1883.7	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXLBRR2	2046.3	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXLGAR2	2046.3	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXMDWR1	1388.9	.0 (0)	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXMIAR1	1919.0	162.0 (8)	162.0 (8)	177.0 (9)	36.0 (1)	36.0 (1)	24.0 (1)
LAXMSYR1	1336.5	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXOMAR1	1049.8	.0 (0)	39.0 (3)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXORDR1	1388.9	.0 (0)	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXORDR2	1393.8	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXPDXR1	645.7	3.0 (0)	.0 (0)	15.0 (2)	27.0 (4)	27.0 (4)	15.0 (2)
LAXSEAR1	736.0	3.0 (0)	.0 (0)	15.0 (2)	27.0 (3)	27.0 (3)	15.0 (2)
LAXSTLR1	1278.2	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
LGALAXR2	2031.0	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
LGAMIAR1	847.0	39.0 (4)	69.0 (8)	39.0 (4)	.0 (0)	.0 (0)	.0 (0)
LGAPBIR1	791.0	36.0 (4)	69.0 (8)	39.0 (4)	.0 (0)	.0 (0)	.0 (0)
LGASFOR1	2123.0	.0 (0)	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)
MDWLAXR1	1396.6	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
MDWSFOR1	1486.2	.0 (0)	.0 (0)	15.0 (1)	.0 (0)	.0 (0)	.0 (0)
MIAABQR1	1381.9	72.0 (5)	108.0 (7)	78.0 (5)	21.0 (1)	15.0 (1)	21.0 (1)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-CS COVERAGE	NO RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
MIABCLR1	959.7	75.0 (7)	75.0 (7)	192.0 (20)	.0 (0)	.0 (0)	.0 (0)
MIABESR1	1,20.5	177.0 (17)	177.0 (17)	213.0 (20)	.0 (0)	.0 (0)	.0 (0)
MIACALR1	888.1	7.0 (8)	108.0 (12)	78.0 (8)	21.0 (2)	15.0 (1)	21.0 (2)
MIAE.6R1	858.8	75.0 (8)	75.0 (8)	192.0 (22)	.0 (0)	.0 (0)	.0 (0)
MIAIABR1	755.0	162.0 (21)	177.0 (23)	162.0 (21)	36.0 (4)	24.0 (3)	36.0 (4)
MIA.FAR1	858.8	75.0 (8)	75.0 (8)	192.0 (22)	.0 (0)	.0 (0)	.0 (0)
MIALABR1	1923.7	162.0 (8)	177.0 (9)	162.0 (8)	36.0 (1)	24.0 (1)	36.0 (1)
MIALCAR1	858.8	75.0 (8)	75.0 (8)	192.0 (22)	.0 (0)	.0 (0)	.0 (0)
MIAMEYR1	506.8	75.0 (15)	108.0 (21)	78.0 (15)	21.0 (4)	15.0 (2)	21.0 (4)
MIAPMLR1	755.0	39.0 (4)	39.0 (4)	69.0 (8)	.0 (0)	.0 (0)	.0 (0)
MIASPER1	2138.0	90.0 (4)	120.0 (5)	111.0 (5)	21.0 (0)	15.0 (0)	21.0 (0)
MNCSPER1	1194.2	6.0 (0)	21.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
MSPSPER1	1274.8	57.0 (4)	42.0 (3)	63.0 (4)	.0 (0)	.0 (0)	.0 (0)
MSYLABR1	1337.1	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
MSYMIAR1	498.2	78.0 (15)	78.0 (15)	108.0 (21)	21.0 (4)	21.0 (4)	15.0 (3)
MSYTPAR1	336.2	.0 (0)	.0 (0)	84.0 (24)	.0 (0)	.0 (0)	.0 (0)
OAK.FAR1	2130.4	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
OAKLABR1	248.6	.0 (0)	15.0 (6)	12.0 (4)	.0 (0)	.0 (0)	.0 (0)
OPALABR1	1056.6	.0 (0)	3.0 (0)	39.0 (3)	.0 (0)	.0 (0)	.0 (0)
ONTCHCR1	1388.9	.0 (0)	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
ERCLASR1	1222.9	6.0 (1)	24.0 (1)	30.0 (2)	.0 (0)	.0 (0)	.0 (0)
ERCLAXR1	1396.6	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCLAXR2	1399.5	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCOAKR1	1486.2	.0 (0)	.0 (0)	15.0 (1)	.0 (0)	.0 (0)	.0 (0)
ERCONTR1	1396.6	.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCRCXR1	1411.7	6.0 (0)	30.0 (2)	21.0 (1)	.0 (0)	.0 (0)	.0 (0)
ERCSFCR1	1486.2	.0 (0)	.0 (0)	15.0 (1)	.0 (0)	.0 (0)	.0 (0)
ERCSFCR3	1495.1	9.0 (1)	42.0 (2)	63.0 (4)	.0 (0)	.0 (0)	.0 (0)
ERCS_CR1	1486.2	.0 (0)	.0 (0)	15.0 (1)	.0 (0)	.0 (0)	.0 (0)
ERCSLCR1	589.2	6.0 (0)	3.0 (0)	39.0 (3)	.0 (0)	.0 (0)	.0 (0)
FBILFKR1	792.5	39.0 (4)	39.0 (4)	69.0 (8)	.0 (0)	.0 (0)	.0 (0)
FBILGAR1	792.5	39.0 (4)	39.0 (4)	69.0 (8)	.0 (0)	.0 (0)	.0 (0)
FCXLAXR1	634.7	.0 (0)	3.0 (0)	3.0 (0)	27.0 (4)	27.0 (4)	24.0 (3)
FCXERCR1	1422.8	6.0 (0)	21.0 (1)	30.0 (2)	.0 (0)	.0 (0)	.0 (0)
FCXSLCR1	466.1	.0 (0)	.0 (0)	15.0 (3)	.0 (0)	.0 (0)	.0 (0)
FBLFLLR1	791.9	39.0 (4)	69.0 (8)	39.0 (4)	.0 (0)	.0 (0)	.0 (0)
FBLMIAR1	791.9	39.0 (4)	69.0 (8)	39.0 (4)	.0 (0)	.0 (0)	.0 (0)
FBXCENR1	423.1	.0 (0)	15.0 (3)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
FACLASR1	214.2	.0 (0)	30.0 (14)	3.0 (1)	.0 (0)	.0 (0)	.0 (0)
SEACENR1	800.8	.0 (0)	5.0 (1)	18.0 (2)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SEA_FKR1	2001.5	.0 (0)	9.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
SEALARR1	735.9	.0 (0)	3.0 (0)	3.0 (0)	27.0 (3)	27.0 (3)	24.0 (3)
SFCABGR1	666.0	18.0 (1)	33.0 (4)	12.0 (1)	.0 (0)	.0 (0)	.0 (0)
SFCATLR1	1750.4	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFCBCIR1	348.2	48.0 (13)	36.0 (10)	54.0 (15)	.0 (0)	.0 (0)	.0 (0)
SFCBCSR1	2248.9	348.0 (15)	369.0 (16)	333.0 (14)	.0 (0)	.0 (0)	.0 (0)
SFCDALR1	1159.6	12.0 (1)	33.0 (2)	12.0 (1)	.0 (0)	.0 (0)	.0 (0)
SFCDENR1	729.4	9.0 (1)	12.0 (1)	6.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFCELPR1	2130.4	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFCGEOR1	535.8	.0 (0)	.0 (0)	18.0 (3)	.0 (0)	.0 (0)	.0 (0)
SFCIADR1	2002.1	.0 (0)	.0 (0)	18.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFCIAHR1	1307.5	.0 (0)	15.0 (1)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFC_FKR1	2130.4	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFC_FKR3	2138.6	24.0 (1)	63.0 (2)	42.0 (1)	.0 (0)	.0 (0)	.0 (0)
SFCLASR1	248.6	.0 (0)	15.0 (6)	12.0 (4)	.0 (0)	.0 (0)	.0 (0)
SFCLGAR1	2130.4	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
SFCMIAR1	2132.4	90.0 (4)	111.0 (5)	120.0 (5)	21.0 (0)	21.0 (0)	15.0 (0)
SFCMKER1	1194.9	6.0 (0)	.0 (0)	21.0 (1)	.0 (0)	.0 (0)	.0 (0)
SFCMSPR1	1278.1	57.0 (4)	63.0 (4)	42.0 (3)	.0 (0)	.0 (0)	.0 (0)
SFCORDR2	1482.2	.0 (0)	15.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SFESLCR1	415.7	61.0 (5)	60.0 (14)	12.0 (2)	.0 (0)	.0 (0)	.0 (0)
SFESTLR1	1403.3	6.0 (0)	.0 (0)	21.0 (1)	.0 (0)	.0 (0)	.0 (0)
SLCDEXR1	729.6	9.0 (1)	12.0 (1)	6.0 (0)	.0 (0)	.0 (0)	.0 (0)
SLCLFSR1	2130.6	.0 (0)	15.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
SLCLASR1	248.6	.0 (0)	15.0 (6)	12.0 (4)	.0 (0)	.0 (0)	.0 (0)
SLCORDR1	986.6	6.0 (0)	39.0 (3)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
SLCPDXR1	461.3	.0 (0)	15.0 (3)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
SLCSFCR1	411.9	61.0 (5)	12.0 (2)	60.0 (14)	.0 (0)	.0 (0)	.0 (0)
STLLAXR1	1272.6	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
STLSFCR1	1399.8	6.0 (0)	21.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
TRAMSYR1	340.2	.0 (0)	84.0 (24)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
TOTAL	182671.2	4362.0 (2)	6075.0 (3)	6405.0 (3)	426.0 (0)	378.0 (0)	348.0 (0)

APPENDIX C

PROBLEM ROUTE SUMMARY, HYPOTHETICAL RNAV ROUTE STRUCTURE, AC 90-45A CROSS-COURSE ERROR, ROUTE WIDTH = $\pm$5 NMI

****** PROBLEM ROUTE SUMMARY ****** (SP)= 5.0 MILES ; OFFSET DIST. =10.0MILES

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
ABGATLR1	1017.1	.0 (0)	.0 (0)	.0 (0)	9.0 (0)	9.0 (0)	18.0 (1)
ABGCALR1	401.7	.0 (0)	.0 (0)	.0 (0)	9.0 (2)	18.0 (4)	9.0 (2)
ABGCENR1	205.5	.0 (0)	.0 (0)	27.0 (13)	3.0 (1)	3.0 (1)	3.0 (1)
ABGMCCR1	667.8	.0 (0)	.0 (0)	6.0 (0)	30.0 (4)	30.0 (4)	21.0 (3)
ABGMCWR1	870.3	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
ABGMIAR1	1374.5	75.0 (5)	78.0 (5)	126.0 (9)	78.0 (5)	87.0 (6)	60.0 (4)
ABGMSVR1	792.0	.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	18.0 (2)	9.0 (1)
ABGORDR1	870.3	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
ABGSFOR1	671.0	12.0 (1)	18.0 (2)	36.0 (5)	3.0 (0)	3.0 (0)	.0 (0)
AMACALR1	185.9	.0 (0)	.0 (0)	.0 (0)	21.0 (11)	9.0 (4)	21.0 (11)
ATLABGR1	1020.2	.0 (0)	.0 (0)	.0 (0)	9.0 (0)	18.0 (1)	9.0 (0)
ATLBLER1	530.9	.0 (0)	15.0 (2)	.0 (0)	6.0 (1)	6.0 (1)	6.0 (1)
ATLCLER1	395.0	.0 (0)	.0 (0)	21.0 (5)	.0 (0)	.0 (0)	.0 (0)
ATLCALR1	554.1	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	9.0 (1)
ATLLAXR1	1590.4	.0 (0)	.0 (0)	.0 (0)	9.0 (0)	18.0 (1)	9.0 (0)
ATLMEMR1	204.8	.0 (0)	.0 (0)	.0 (0)	18.0 (8)	18.0 (8)	27.0 (13)
ATLPITR1	370.4	.0 (0)	15.0 (4)	.0 (0)	6.0 (1)	6.0 (1)	6.0 (1)
ATLSFOR1	1754.9	.0 (0)	21.0 (1)	21.0 (1)	36.0 (2)	39.0 (2)	36.0 (2)
BALBNAR1	390.9	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	21.0 (5)	21.0 (5)
BALCALR1	936.7	.0 (0)	.0 (0)	.0 (0)	54.0 (5)	54.0 (5)	54.0 (5)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-ES COVERAGE	NO RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
BALLAAR1	1885.9	.0 (0)	18.0 (0)	.0 (0)	6.0 (0)	.0 (0)	6.0 (0)
BALMIAR1	703.2	.0 (0)	6.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	3.0 (0)
BALSEAR1	1921.3	.0 (0)	.0 (0)	.0 (0)	18.0 (0)	18.0 (0)	27.0 (1)
BDLMIAR1	950.9	78.0 (7)	228.0 (23)	75.0 (7)	60.0 (6)	162.0 (17)	45.0 (4)
BHMLGAR1	650.7	.0 (0)	12.0 (1)	.0 (0)	.0 (0)	3.0 (0)	.0 (0)
BHMMEAR1	93.3	.0 (0)	.0 (0)	3.0 (3)	.0 (0)	.0 (0)	3.0 (3)
BNAEALR1	387.6	.0 (0)	.0 (0)	.0 (0)	18.0 (4)	6.0 (1)	18.0 (4)
BNADALR1	458.3	.0 (0)	.0 (0)	.0 (0)	33.0 (7)	33.0 (7)	33.0 (7)
BNADCAR1	387.6	.0 (0)	.0 (0)	.0 (0)	18.0 (4)	6.0 (1)	18.0 (4)
BNAMEMR1	87.1	.0 (0)	.0 (0)	.0 (0)	33.0 (37)	33.0 (37)	33.0 (37)
BNAPELR1	503.9	.0 (0)	.0 (0)	.0 (0)	18.0 (3)	18.0 (3)	6.0 (1)
BNAPITR1	312.5	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	15.0 (4)	15.0 (4)
BOICEAR1	469.6	.0 (0)	.0 (0)	.0 (0)	39.0 (8)	51.0 (10)	39.0 (8)
BOIFCAR1	209.6	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (4)
BOISFOR1	348.9	48.0 (13)	69.0 (19)	36.0 (10)	.0 (0)	6.0 (1)	9.0 (2)
BOISLOR1	164.0	.0 (0)	.0 (0)	.0 (0)	3.0 (1)	3.0 (1)	3.0 (1)
BOSDALR1	1270.8	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	.0 (0)
BOSFLLR1	1018.2	198.0 (19)	267.0 (26)	192.0 (18)	240.0 (23)	345.0 (33)	240.0 (23)
BOSLAAR1	2162.0	.0 (0)	12.0 (0)	6.0 (0)	.0 (0)	.0 (0)	.0 (0)
BOSMIAR1	1018.2	198.0 (19)	267.0 (26)	192.0 (18)	240.0 (23)	345.0 (33)	240.0 (23)

ROUTE ID	ROUTE MILES	NS ROUTE COVERAGE	NS LEFT-OS COVERAGE	NS RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
BCSSFCR1	2243.5	315.0 (14)	336.0 (14)	414.0 (18)	99.0 (4)	87.0 (3)	279.0 (12)
BLFATLR1	529.2	.0 (0)	.0 (0)	15.0 (2)	6.0 (1)	6.0 (1)	6.0 (1)
CLEATLR1	392.1	.0 (0)	21.0 (5)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CLELAXR1	1683.6	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CVGICTR1	250.9	.0 (0)	.0 (0)	.0 (0)	6.0 (2)	.0 (0)	6.0 (2)
DALABGR1	406.3	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
DALAMAR1	184.5	.0 (0)	6.0 (3)	.0 (0)	3.0 (1)	3.0 (1)	3.0 (1)
DALATLR1	550.5	.0 (0)	15.0 (2)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
DALBALR1	93.6	.0 (0)	21.0 (2)	.0 (0)	33.0 (3)	33.0 (3)	27.0 (2)
DALBNAR1	457.2	.0 (0)	21.0 (4)	.0 (0)	15.0 (3)	15.0 (3)	21.0 (4)
DALBCSR1	1277.2	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	3.0 (0)
DALCCAR1	93.6	.0 (0)	21.0 (2)	.0 (0)	33.0 (3)	33.0 (3)	27.0 (2)
DALELBR1	391.9	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)	6.0 (1)
DALIADR1	93.6	.0 (0)	21.0 (2)	.0 (0)	33.0 (3)	33.0 (3)	27.0 (2)
DALLFKR1	1110.8	.0 (0)	21.0 (1)	.0 (0)	33.0 (2)	33.0 (2)	27.0 (2)
DALLAXR1	962.5	.0 (0)	6.0 (0)	.0 (0)	21.0 (2)	24.0 (2)	33.0 (3)
DALLBBR1	153.6	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)
DALLGAR1	1110.8	.0 (0)	21.0 (1)	.0 (0)	33.0 (2)	33.0 (2)	27.0 (2)
DALLITR1	177.4	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	.0 (0)
DALMEMR1	284.3	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (2)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
CALMIAR1	888.9	72.0 (8)	72.0 (8)	120.0 (13)	69.0 (7)	69.0 (7)	51.0 (5)
CALPHAR1	671.[illegible]	.0 (0)	6.0 (0)	.0 (0)	21.0 (3)	24.0 (3)	33.0 (4)
CALSFBR1	1162.4	12.0 (1)	18.0 (1)	36.0 (3)	6.0 (0)	6.0 (0)	3.0 (0)
CCABNAR1	390.9	.0 (0)	.0 (0)	.0 (0)	21.0 (5)	21.0 (5)	21.0 (5)
CCACALR1	936.7	.0 (0)	.0 (0)	.0 (0)	54.0 (5)	54.0 (5)	54.0 (5)
CCAMEMR1	565.5	.0 (0)	.0 (0)	.0 (0)	54.0 (9)	54.0 (9)	54.0 (9)
CCAMIAR1	703.2	.0 (0)	6.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	3.0 (0)
CCATYSR1	288.9	.0 (0)	.0 (0)	9.0 (3)	.0 (0)	.0 (0)	9.0 (3)
CENABGR1	207.7	.0 (0)	21.0 (10)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
CENBCIR1	474.9	.0 (0)	21.0 (4)	27.0 (5)	33.0 (6)	33.0 (6)	33.0 (6)
CENICTR1	286.1	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	6.0 (2)
CENLASR1	446.3	24.0 (5)	9.0 (2)	45.0 (10)	.0 (0)	.0 (0)	.0 (0)
CENLAXR1	632.4	6.0 (0)	18.0 (2)	39.0 (6)	.0 (0)	3.0 (0)	.0 (0)
CENMSFR1	514.8	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	.0 (0)
CENPCXR1	770.1	.0 (0)	18.0 (2)	21.0 (2)	39.0 (5)	48.0 (6)	39.0 (5)
CENPHXR1	426.[illegible]	.0 (0)	3.0 (0)	12.0 (2)	.0 (0)	.0 (0)	.0 (0)
CENSEAR1	798.1	.0 (0)	39.0 (4)	30.0 (3)	30.0 (3)	30.0 (3)	18.0 (2)
CENSFGR1	721.4	3.0 (0)	27.0 (3)	.0 (0)	30.0 (4)	21.0 (2)	30.0 (4)
CENSLOR1	721.4	3.0 (0)	27.0 (3)	.0 (0)	30.0 (4)	21.0 (2)	30.0 (4)
CENSLOR1	282.6	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	9.0 (3)	9.0 (3)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-OS COVERAGE MILES (%)	NO RIGHT-OS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-OS >(SP) MILES (%)	RIGHT-OS >(SP) MILES (%)
DSMLAKR1	1155.6	.0 (0)	12.0 (1)	54.0 (4)	.0 (0)	3.0 (0)	.0 (0)
DTWLAKR1	1616.1	.0 (0)	12.0 (0)	6.0 (0)	.0 (0)	.0 (0)	.0 (0)
DTWSFCR1	1706.1	.0 (0)	.0 (0)	.0 (0)	45.0 (2)	36.0 (2)	45.0 (2)
ELFCALR1	390.1	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	6.0 (1)	.0 (0)
ELFLEVR1	418.1	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
ELFSATR1	342.0	.0 (0)	.0 (0)	12.0 (3)	.0 (0)	.0 (0)	.0 (0)
EMRFLLR1	847.3	75.0 (8)	228.0 (26)	75.0 (8)	57.0 (6)	159.0 (18)	42.0 (4)
EMRIAMR1	1125.6	.0 (0)	.0 (0)	12.0 (1)	.0 (0)	.0 (0)	.0 (0)
EMRLAKR2	2031.0	.0 (0)	18.0 (0)	.0 (0)	6.0 (0)	.0 (0)	6.0 (0)
EMRLAKR3	2046.3	.0 (0)	9.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	9.0 (0)
EMRMIAR1	847.0	39.0 (4)	99.0 (11)	39.0 (4)	54.0 (6)	15.0 (1)	45.0 (5)
EMRSFCR1	2123.0	.0 (0)	.0 (0)	27.0 (1)	45.0 (2)	45.0 (2)	36.0 (1)
FLLBCSR1	1020.5	177.0 (17)	177.0 (17)	270.0 (26)	252.0 (24)	252.0 (24)	345.0 (33)
FLLEMRR1	858.8	75.0 (8)	75.0 (8)	315.0 (36)	48.0 (5)	33.0 (3)	159.0 (18)
FLLMFKR1	858.8	75.0 (8)	75.0 (8)	315.0 (36)	48.0 (5)	33.0 (3)	159.0 (18)
FLLPHLR1	795.0	39.0 (4)	39.0 (4)	105.0 (13)	63.0 (7)	54.0 (6)	24.0 (3)
GEGSFCR1	536.5	.0 (0)	36.0 (6)	6.0 (1)	9.0 (1)	9.0 (1)	9.0 (1)
IADCALR1	936.7	.0 (0)	.0 (0)	.0 (0)	54.0 (5)	54.0 (5)	54.0 (5)
IADLAKR1	1885.9	.0 (0)	18.0 (0)	.0 (0)	6.0 (0)	.0 (0)	6.0 (0)
IADMEMR1	565.5	.0 (0)	.0 (0)	.0 (0)	54.0 (9)	54.0 (9)	54.0 (9)

ROUTE ID	ROUTE MILES	NP ROUTE COVERAGE	NP LEFT-ES COVERAGE	NP RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
IADMIAR1	703.2	.0 (0)	6.0 (0)	.0 (0)	3.0 (0)	9.0 (1)	3.0 (0)
IADSEAR1	1921.3	.0 (0)	.0 (0)	.0 (0)	18.0 (0)	18.0 (0)	27.0 (1)
IADSFOR1	1999.7	.0 (0)	24.0 (1)	3.0 (0)	21.0 (1)	21.0 (1)	21.0 (1)
IAHEWRR1	1132.5	.0 (0)	12.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
IAHLFKR1	1132.5	.0 (0)	12.0 (1)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
IAHLEER1	312.3	.0 (0)	6.0 (1)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
IAHMIAR1	745.9	162.0 (21)	162.0 (21)	177.0 (23)	123.0 (16)	123.0 (16)	108.0 (14)
IAHSFOR1	1312.-	.0 (0)	9.0 (0)	21.0 (1)	15.0 (1)	12.0 (0)	.0 (0)
ICTCVOR1	253.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)
ICTLLKR1	253.8	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (1)
LFKDALR1	1103.3	.0 (0)	.0 (0)	.0 (0)	54.0 (4)	54.0 (4)	54.0 (4)
LFKFLLR1	847.3	75.0 (8)	228.0 (26)	75.0 (8)	57.0 (6)	159.0 (18)	42.0 (4)
LFKIAHR1	1125.6	.0 (0)	.0 (0)	12.0 (1)	.0 (0)	.0 (0)	.0 (0)
LFKLASR1	1846.7	.0 (0)	9.0 (0)	6.0 (0)	.0 (0)	9.0 (0)	.0 (0)
LFKLAXR2	2031.0	.0 (0)	18.0 (0)	.0 (0)	6.0 (0)	.0 (0)	6.0 (0)
LFKLAXR3	2046.3	.0 (0)	9.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	9.0 (0)
LFKMIAR1	847.3	75.0 (8)	228.0 (26)	75.0 (8)	57.0 (6)	159.0 (18)	42.0 (4)
LFKOAKR1	2123.0	.0 (0)	.0 (0)	27.0 (1)	45.0 (2)	45.0 (2)	36.0 (1)
LFKORFR1	152.3	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	6.0 (3)	.0 (0)
LFKPEIR1	791.0	39.0 (4)	99.0 (12)	39.0 (4)	54.0 (6)	15.0 (1)	45.0 (5)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-OS COVERAGE MILES (%)	NO RIGHT-OS COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-OE >(SP) MILES (%)	RIGHT-OS >(SP) MILES (%)
LFKFFXF1	1765.8	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
LFKSEAF1	1994.5	.0 (0)	3.0 (0)	48.0 (2)	75.0 (3)	75.0 (3)	84.0 (4)
LFKSFOF1	2123.0	.0 (0)	.0 (0)	27.0 (1)	45.0 (2)	45.0 (2)	36.0 (1)
LFKSFOF2	2125.3	.0 (0)	24.0 (1)	3.0 (0)	21.0 (0)	21.0 (0)	21.0 (0)
LFKSFOF3	2141.1	24.0 (1)	42.0 (1)	138.0 (6)	45.0 (2)	30.0 (1)	42.0 (1)
LFKS_OF1	2123.0	.0 (0)	.0 (0)	27.0 (1)	45.0 (2)	45.0 (2)	36.0 (1)
LASDENF1	452.2	6.0 (1)	51.0 (11)	12.0 (2)	.0 (0)	.0 (0)	.0 (0)
LAS_FKF1	1841.7	.0 (0)	6.0 (0)	9.0 (0)	.0 (0)	.0 (0)	9.0 (0)
LASOAKF1	252.2	.0 (0)	9.0 (3)	21.0 (8)	15.0 (5)	12.0 (4)	.0 (0)
LASORDF1	1220.1	21.0 (1)	45.0 (3)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LASRNDF1	210.8	.0 (0)	3.0 (1)	51.0 (24)	.0 (0)	.0 (0)	.0 (0)
LASSFOF1	252.2	.0 (0)	9.0 (3)	21.0 (8)	15.0 (5)	12.0 (4)	.0 (0)
LASS_OF1	252.2	.0 (0)	9.0 (3)	21.0 (8)	15.0 (5)	12.0 (4)	.0 (0)
LASSLOF1	233.9	.0 (0)	6.0 (2)	6.0 (2)	18.0 (7)	18.0 (7)	18.0 (7)
LAXATLF1	1583.7	.0 (0)	.0 (0)	.0 (0)	9.0 (0)	9.0 (0)	18.0 (1)
LAXBALF1	1883.7	.0 (0)	.0 (0)	18.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
LAXBOSF1	2162.5	.0 (0)	6.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXCLEF1	1674.3	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXCALF1	961.5	.0 (0)	.0 (0)	6.0 (0)	21.0 (2)	33.0 (3)	24.0 (2)
LAXDENF1	629.9	.0 (0)	57.0 (9)	12.0 (1)	.0 (0)	.0 (0)	3.0 (0)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-ES COVERAGE	% RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
LAXCSMR1	1152.8	.0 (0)	54.0 (4)	12.0 (1)	.0 (0)	.0 (0)	3.0 (0)
LAXCTOR1	1612.5	.0 (0)	6.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXEARR2	2046.3	.0 (0)	.0 (0)	18.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
LAXEARR3	2052.1	.0 (0)	.0 (0)	9.0 (0)	3.0 (0)	9.0 (0)	3.0 (0)
LAXIADR1	1883.7	.0 (0)	.0 (0)	18.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
LAXLFRR2	2046.3	.0 (0)	.0 (0)	18.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
LAXLFRR3	2052.1	.0 (0)	.0 (0)	9.0 (0)	3.0 (0)	9.0 (0)	3.0 (0)
LAXLGAR2	2046.3	.0 (0)	.0 (0)	18.0 (0)	6.0 (0)	6.0 (0)	.0 (0)
LAXLGAR3	2052.1	.0 (0)	.0 (0)	9.0 (0)	3.0 (0)	9.0 (0)	3.0 (0)
LAXMDNR1	1388.9	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXMEMR1	129.3	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	9.0 (0)
LAXMIAR1	1919.6	162.0 (8)	162.0 (8)	177.0 (9)	123.0 (6)	123.0 (6)	108.0 (5)
LAXMSER1	1226.6	.0 (0)	9.0 (0)	.0 (0)	24.0 (1)	24.0 (1)	9.0 (0)
LAXMSYR1	1336.5	.0 (0)	3.0 (0)	.0 (0)	3.0 (0)	15.0 (1)	.0 (0)
LAXOMAR1	1049.8	.0 (0)	54.0 (5)	12.0 (1)	.0 (0)	.0 (0)	3.0 (0)
LAXORCR1	1388.9	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXORCR2	1393.8	.0 (0)	6.0 (0)	12.0 (0)	.0 (0)	.0 (0)	.0 (0)
LAXPCAR1	645.7	3.0 (0)	.0 (0)	3.0 (0)	57.0 (8)	57.0 (8)	57.0 (8)
LAXSATR1	935.5	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	12.0 (1)
LAXSEAR1	736.0	3.0 (0)	.0 (0)	3.0 (0)	57.0 (7)	57.0 (7)	57.0 (7)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-CS COVERAGE	% RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
LAXSLCR1	417.1	.0 (0)	6.0 (1)	3.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
LAXSTLR1	1275.2	.0 (0)	.0 (0)	18.0 (1)	6.0 (0)	6.0 (0)	.0 (0)
LBBIABR1	310.8	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	6.0 (1)	6.0 (1)
LGABRMR1	644.9	.0 (0)	.0 (0)	12.0 (1)	.0 (0)	.0 (0)	3.0 (0)
LGACALR1	1103.9	.0 (0)	.0 (0)	.0 (0)	54.0 (4)	54.0 (4)	54.0 (4)
LGALABR2	2031.0	.0 (0)	18.0 (0)	.0 (0)	6.0 (0)	.0 (0)	6.0 (0)
LGALABR3	2046.3	.0 (0)	9.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	9.0 (0)
LGAMEMR1	732.1	.0 (0)	.0 (0)	.0 (0)	54.0 (7)	54.0 (7)	54.0 (7)
LGAMIAR1	847.0	39.0 (4)	99.0 (11)	39.0 (4)	54.0 (6)	15.0 (1)	45.0 (5)
LGAORRR1	152.3	.0 (0)	.0 (0)	.0 (0)	6.0 (3)	6.0 (3)	.0 (0)
LGAPEIR1	791.0	39.0 (4)	99.0 (12)	39.0 (4)	54.0 (6)	15.0 (1)	45.0 (5)
LGASFCR1	2123.0	.0 (0)	.0 (0)	27.0 (1)	45.0 (2)	45.0 (2)	36.0 (1)
LSVELER1	419.2	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
LLKICTR1	250.9	.0 (0)	.0 (0)	.0 (0)	6.0 (2)	.0 (0)	6.0 (2)
MCCABGR1	665.3	.0 (0)	6.0 (0)	.0 (0)	30.0 (4)	21.0 (3)	30.0 (4)
MCHABGR1	869.7	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
MCHLABR1	1396.6	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
MCHPHBR1	1149.7	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)
MCHSFCR1	1486.2	.0 (0)	.0 (0)	27.0 (1)	45.0 (3)	45.0 (3)	36.0 (2)
MEPATLR1	202.9	.0 (0)	.0 (0)	6.0 (2)	15.0 (7)	15.0 (7)	21.0 (10)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-ES COVERAGE	NO RIGHT-ES COVERAGE	ROUTE WIDTH >(SP)	LEFT-ES >(SP)	RIGHT-ES >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
MEMBHAR1	9e.C	.C (C)	12.C (12)	.C (C)	6.C (6)	6.C (6)	6.C (6)
MEMENAR1	84.6	.C (C)	.C (C)	21.C (24)	15.C (17)	15.C (17)	15.C (17)
MEMCCAR1	562.C	.C (C)	21.C (3)	.C (C)	33.C (5)	33.C (5)	21.C (3)
MEMIACR1	562.C	.C (C)	21.C (3)	.C (C)	33.C (5)	33.C (5)	21.C (3)
MEMLANR1	1303.6	.C (C)	.C (C)	.C (C)	.C (C)	9.C (C)	.C (C)
MEMLGAR1	738.2	.C (C)	21.C (2)	.C (C)	33.C (4)	33.C (4)	21.C (2)
MEMSCRR1	188.6	.C (C)	30.C (15)	.C (C)	.C (C)	.C (C)	.C (C)
MIAABGR1	1381.9	78.C (5)	126.C (9)	78.C (5)	78.C (5)	60.C (4)	87.C (6)
MIABALR1	710.3	.C (C)	.C (C)	6.C (C)	3.C (C)	3.C (C)	9.C (1)
MIABCLR1	959.7	75.C (7)	75.C (7)	315.C (32)	48.C (5)	33.C (3)	159.C (16)
MIABGSR1	1020.5	177.C (17)	177.C (17)	270.C (26)	252.C (24)	252.C (24)	345.C (33)
MIACALR1	888.1	75.C (8)	123.C (13)	78.C (8)	69.C (7)	51.C (5)	69.C (7)
MIACCAR1	710.3	.C (C)	.C (C)	6.C (C)	3.C (C)	3.C (C)	9.C (1)
MIAEWRR1	858.8	75.C (8)	75.C (8)	315.C (36)	48.C (5)	33.C (3)	159.C (18)
MIAIAER1	710.3	.C (C)	.C (C)	6.C (C)	3.C (C)	3.C (C)	9.C (1)
MIAIAWR1	755.C	162.C (21)	177.C (23)	162.C (21)	123.C (16)	108.C (14)	123.C (16)
MIALFWR1	858.8	75.C (8)	75.C (8)	315.C (36)	48.C (5)	33.C (3)	159.C (18)
MIALANR1	1963.7	162.C (8)	177.C (9)	162.C (8)	123.C (6)	108.C (5)	123.C (6)
MIALGAR1	858.8	75.C (8)	75.C (8)	315.C (36)	48.C (5)	33.C (3)	159.C (18)
MIAMSYR1	806.8	78.C (15)	123.C (24)	78.C (15)	69.C (13)	51.C (10)	69.C (13)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-CS COVERAGE	% RIGHT-CS COVERAGE	ROUTE WIDTH >(SP)	LEFT-CS >(SP)	RIGHT-CS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
MIAPPLR1	795.0	39.0 (4)	39.0 (4)	105.0 (13)	63.0 (7)	54.0 (6)	24.0 (3)
MIASPCR1	2139.0	9 .0 (4)	144.0 (6)	114.0 (5)	81.0 (3)	63.0 (2)	87.0 (4)
MNCSPCR1	1194.2	6.0 (0)	24.0 (2)	.0 (0)	30.0 (2)	21.0 (1)	30.0 (2)
MSPCEAR1	510.8	.0 (0)	.0 (0)	.0 (0)	9.0 (1)	.0 (0)	9.0 (1)
MSPLAKR1	1230.6	.0 (0)	.0 (0)	9.0 (0)	24.0 (1)	9.0 (0)	24.0 (1)
MSPSEAR1	1131.2	.0 (0)	.0 (0)	.0 (0)	18.0 (1)	18.0 (1)	27.0 (2)
MSPSPCR1	1274.8	57.0 (4)	42.0 (3)	51.0 (4)	258.0 (20)	249.0 (19)	243.0 (19)
MSYABGR1	793.6	.0 (0)	3.0 (0)	.0 (0)	9.0 (1)	9.0 (1)	18.0 (2)
MSYLAKR1	1337.1	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	.0 (0)	15.0 (1)
MSYPIAR1	498.2	78.0 (15)	78.0 (15)	123.0 (24)	69.0 (13)	69.0 (13)	51.0 (10)
MSYTEAR1	330.2	.0 (0)	.0 (0)	117.0 (34)	33.0 (9)	21.0 (6)	12.0 (3)
OAK_FAR1	2130.4	.0 (0)	27.0 (1)	3.0 (0)	42.0 (1)	33.0 (1)	42.0 (1)
OAKLAKR1	248.6	.0 (0)	21.0 (8)	9.0 (3)	15.0 (6)	.0 (0)	12.0 (4)
OAKSPCR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	42.0 (2)	42.0 (2)	33.0 (2)
OPALAKR1	1056.6	.0 (0)	12.0 (1)	54.0 (5)	.0 (0)	3.0 (0)	.0 (0)
OWYSPCR1	1388.9	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)
SRCABGR1	869.7	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
SRCCALR1	601.5	.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)	3.0 (0)
SRCICTR1	424.7	.0 (0)	.0 (0)	.0 (0)	6.0 (1)	.0 (0)	6.0 (1)
SRCLAKR1	1222.9	6.0 (1)	12.0 (0)	45.0 (3)	.0 (0)	.0 (0)	.0 (0)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
ERCLAXR1	1356.6	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCLAXR2	1399.5	.0 (0)	12.0 (0)	6.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCOAXR1	1486.2	.0 (0)	.0 (0)	27.0 (1)	45.0 (3)	45.0 (3)	36.0 (2)
ERCONTR1	1396.6	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCPCXR1	1411.7	.0 (0)	42.0 (2)	21.0 (1)	36.0 (2)	30.0 (2)	18.0 (1)
ERCPHXR1	1149.7	.0 (0)	.0 (0)	9.0 (0)	.0 (0)	.0 (0)	.0 (0)
ERCSEAR1	1397.6	.0 (0)	6.0 (0)	.0 (0)	15.0 (1)	15.0 (1)	15.0 (1)
ERCSFCR1	1486.2	.0 (0)	.0 (0)	27.0 (1)	45.0 (3)	45.0 (3)	36.0 (2)
ERCSFCR2	1493.3	.0 (0)	3.0 (0)	3.0 (0)	33.0 (2)	39.0 (2)	45.0 (3)
ERCSFCR3	1496.1	24.0 (1)	42.0 (2)	138.0 (9)	45.0 (3)	30.0 (2)	42.0 (2)
ERCSLCR1	1486.2	.0 (0)	.0 (0)	27.0 (1)	45.0 (3)	45.0 (3)	36.0 (2)
ERCSLCR1	989.2	6.0 (0)	.0 (0)	57.0 (5)	18.0 (1)	27.0 (2)	18.0 (1)
ERCTLSR1	1147.5	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
FBILFXR1	792.5	39.0 (4)	39.0 (4)	105.0 (13)	63.0 (7)	54.0 (6)	24.0 (3)
FBILGAR1	792.5	39.0 (4)	39.0 (4)	105.0 (13)	63.0 (7)	54.0 (6)	24.0 (3)
FCXCENR1	768.6	.0 (0)	21.0 (2)	3.0 (0)	39.0 (5)	51.0 (6)	48.0 (6)
FCXLAXR1	634.7	.0 (0)	30.0 (4)	3.0 (0)	57.0 (8)	51.0 (8)	54.0 (8)
FCXSFCR1	1422.8	6.0 (0)	21.0 (1)	42.0 (2)	36.0 (2)	18.0 (1)	30.0 (2)
FCXSLCR1	466.1	.0 (0)	3.0 (0)	24.0 (5)	27.0 (5)	27.0 (5)	6.0 (1)
FNLBNAR1	499.7	.0 (0)	.0 (0)	.0 (0)	21.0 (4)	21.0 (4)	21.0 (4)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
FRLFLLR1	791.9	39.C (4)	96.C (12)	39.C (4)	54,C (6)	15.C (1)	45.C (5)
FRLMIAR1	791.9	39.C (4)	96.C (12)	39.C (4)	54.C (6)	15.C (1)	45.C (5)
FRLSFCR1	2093.6	.C (C)	.C (C)	.C (C)	45,C (2)	36.C (1)	45.C (2)
FRXCALR1	665.8	.C (C)	.C (0)	6.C (C)	21,C (3)	33.C (4)	24.C (3)
FRXCENR1	423.1	.C (C)	15.C (3)	3.C (C)	9,C (2)	.C (C)	9.C (2)
FRX_FXR1	1781.7	.C (C)	.C (C)	.C (C)	3,C (C)	3.C (C)	3.C (0)
FRXMC.R1	1153.3	.C (C)	9.C (C)	.C (C)	,C (0)	.C (C)	.C (0)
FRXORCR1	1153.3	.C (C)	9.C (0)	.C (C)	,C (0)	.C (C)	.C (0)
FRXSTLR1	1010.6	.C (C)	.C (C)	.C (C)	3,C (0)	3.C (C)	3.C (0)
FITATLR1	368.7	.C (C)	.C (C)	15.C (4)	6,C (1)	6.C (1)	6.C (1)
FITENNR1	314.9	.C (C)	.C (C)	.C (C)	6,C (1)	15.C (4)	15.C (4)
FITSCFR1	202.7	.C (C)	3.C (1)	.C (C)	,C (0)	.C (C)	.C (0)
RNCLASR1	214.2	.C (C)	51.C (23)	3.C (1)	,C (0)	.C (C)	.C (0)
SATELFR1	342.9	.C (C)	15.C (4)	.C (C)	,C (0)	.C (C)	.C (0)
SATLAXR1	936.8	.C (C)	9.C (C)	.C (C)	,C (0)	12.C (1)	.C (0)
SCFCCAR1	308.8	.C (C)	.C (0)	3.C (C)	.C (0)	.C (C)	.C (0)
SCFLGAR1	484.7	.C (C)	.C (0)	.C (C)	,C (0)	.C (C)	6.C (1)
SCFMEMR1	188.4	.C (C)	33.C (17)	.C (C)	,C (0)	3.C (1)	.C (0)
SEABALR1	1920.6	.C (C)	.C (0)	.C (C)	18.C (0)	27.C (1)	18.C (0)
SEADENR1	800.9	.C (C)	36.C (4)	60.C (7)	30.C (3)	18.C (2)	30.C (3)

ROUTE ID	ROUTE MILES	% ROUTE COVERAGE	% LEFT-OS COVERAGE	% RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SEAIADR1	1920.6	.0 (0)	.0 (0)	.0 (0)	18.0 (0)	27.0 (1)	18.0 (0)
SEA_FKR1	2001.5	.0 (0)	48.0 (2)	3.0 (0)	75.0 (3)	84.0 (4)	75.0 (3)
SEALAXR1	735.9	.0 (0)	30.0 (4)	3.0 (0)	57.0 (7)	51.0 (6)	54.0 (7)
SEAMSFR1	1126.5	.0 (0)	.0 (0)	.0 (0)	18.0 (1)	27.0 (2)	18.0 (1)
SEABRDR1	1399.4	.0 (0)	.0 (0)	.0 (0)	15.0 (1)	15.0 (1)	18.0 (1)
SFCABGR1	666.0	12.0 (1)	36.0 (5)	18.0 (2)	3.0 (0)	.0 (0)	3.0 (0)
SFCATLR1	1750.4	.0 (0)	9.0 (0)	24.0 (1)	36.0 (2)	36.0 (2)	48.0 (2)
SFCBCIR1	348.2	48.0 (13)	36.0 (10)	69.0 (19)	.0 (0)	9.0 (2)	6.0 (1)
SFCBCSR1	2248.9	345.0 (15)	408.0 (18)	363.0 (16)	99.0 (4)	279.0 (12)	81.0 (3)
SFCDALR1	1159.6	12.0 (1)	36.0 (3)	18.0 (1)	12.0 (1)	18.0 (1)	12.0 (1)
SFCDENR1	729.4	12.0 (1)	18.0 (2)	18.0 (2)	27.0 (3)	27.0 (3)	21.0 (2)
SFCDTWR1	1698.5	.0 (0)	3.0 (0)	.0 (0)	42.0 (2)	42.0 (2)	33.0 (1)
SFCEWBR1	2130.4	.0 (0)	27.0 (1)	3.0 (0)	42.0 (1)	33.0 (1)	42.0 (1)
SFCGEGR1	535.8	.0 (0)	6.0 (1)	36.0 (6)	9.0 (1)	9.0 (1)	9.0 (1)
SFCIADR1	2002.1	.0 (0)	6.0 (0)	30.0 (1)	21.0 (1)	21.0 (1)	21.0 (1)
SFCIAHR1	1307.5	.0 (0)	21.0 (1)	9.0 (0)	15.0 (1)	.0 (0)	12.0 (0)
SFC_FKR1	2130.4	.0 (0)	27.0 (1)	3.0 (0)	42.0 (1)	33.0 (1)	42.0 (1)
SFC_FKR2	2119.7	.0 (0)	9.0 (0)	3.0 (0)	27.0 (1)	39.0 (1)	27.0 (1)
SFC_FKR3	2138.6	24.0 (1)	138.0 (6)	45.0 (2)	48.0 (2)	45.0 (2)	33.0 (1)
SFCLASR1	248.6	.0 (0)	21.0 (8)	9.0 (3)	15.0 (6)	.0 (0)	12.0 (4)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE MILES (%)	NO LEFT-ES COVERAGE MILES (%)	NO RIGHT-ES COVERAGE MILES (%)	ROUTE WIDTH >(SP) MILES (%)	LEFT-ES >(SP) MILES (%)	RIGHT-ES >(SP) MILES (%)
SFCLGAR1	2130.4	.0 (0)	27.0 (1)	3.0 (0)	42.0 (1)	33.0 (1)	42.0 (1)
SFCMDAR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	42.0 (2)	42.0 (2)	33.0 (2)
SFCMIAR1	2132.4	9[illegible].0 (4)	114.0 (5)	144.0 (6)	81.0 (3)	87.0 (4)	63.0 (2)
SFCMKCR1	1194.9	.0 (0)	3.0 (0)	30.0 (2)	30.0 (2)	30.0 (2)	21.0 (1)
SFCMSFR1	1278.1	57.0 (4)	51.0 (3)	42.0 (3)	252.0 (19)	237.0 (18)	243.0 (19)
SFCORCR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	42.0 (2)	42.0 (2)	33.0 (2)
SFCORCR2	1482.2	.0 (0)	27.0 (1)	3.0 (0)	42.0 (2)	33.0 (2)	42.0 (2)
SFCPHLR1	2090.8	.0 (0)	3.0 (0)	.0 (0)	42.0 (2)	42.0 (2)	33.0 (1)
SFCSLCR1	415.7	6[illegible].0 (5)	78.0 (18)	3.0 (0)	24.0 (5)	15.0 (3)	30.0 (7)
SFCSTLR1	1403.3	.0 (0)	3.0 (0)	30.0 (2)	30.0 (2)	30.0 (2)	21.0 (1)
SWCDENR1	729.4	16.0 (1)	18.0 (2)	18.0 (2)	27.0 (3)	27.0 (3)	21.0 (2)
SWCLFKR1	2130.4	.0 (0)	27.0 (1)	3.0 (0)	42.0 (1)	33.0 (1)	42.0 (1)
SWCLASR1	248.0	.0 (0)	21.0 (8)	9.0 (3)	15.0 (6)	.0 (0)	12.0 (4)
SWCORCR1	1481.6	.0 (0)	3.0 (0)	.0 (0)	42.0 (2)	42.0 (2)	33.0 (2)
SLCBCIR1	166.8	.0 (0)	.0 (0)	.0 (0)	21.0 (12)	21.0 (12)	21.0 (12)
SLCDENR1	244.2	.0 (0)	.0 (0)	.0 (0)	9.0 (3)	9.0 (3)	9.0 (3)
SLCLASR1	233.3	.0 (0)	.0 (0)	3.0 (1)	21.0 (9)	21.0 (5)	21.0 (9)
SLCLAXR1	412.4	.0 (0)	3.0 (0)	6.0 (1)	3.0 (0)	3.0 (0)	3.0 (0)
SLCORCR1	986.4	6[illegible].0 (0)	63.0 (6)	.0 (0)	18.0 (1)	18.0 (1)	21.0 (2)
SLCPDXR1	461.3	.0 (0)	24.0 (5)	3.0 (0)	27.0 (5)	6.0 (1)	27.0 (5)

ROUTE ID	ROUTE MILES	NO ROUTE COVERAGE	NO LEFT-OS COVERAGE	NO RIGHT-OS COVERAGE	ROUTE WIDTH >(SP)	LEFT-OS >(SP)	RIGHT-OS >(SP)
		MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)	MILES (%)
SLCSPCR1	411.9	21.0 (5)	.0 (0)	78.0 (18)	21.0 (5)	27.0 (6)	12.0 (2)
STLLARR1	1272.6	.0 (0)	18.0 (1)	.0 (0)	6.0 (0)	.0 (0)	6.0 (0)
STLPHAR1	1007.4	.0 (0)	.0 (0)	.0 (0)	3.0 (0)	3.0 (0)	3.0 (0)
STLSPCR1	1399.8	6.0 (0)	24.0 (1)	.0 (0)	30.0 (2)	21.0 (1)	30.0 (2)
TRAMSAR1	340.2	.0 (0)	99.0 (29)	.0 (0)	54.0 (15)	33.0 (9)	42.0 (12)
TLLSTLR1	215.4	.0 (0)	12.0 (5)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
TLSBADR1	1150.2	.0 (0)	.0 (0)	3.0 (0)	.0 (0)	.0 (0)	.0 (0)
TVSCCAR1	280.2	.0 (0)	12.0 (4)	.0 (0)	.0 (0)	.0 (0)	.0 (0)
TOTAL	308528.6	4368.0 (1)	8154.0 (2)	8751.0 (2)	8196.0 (2)	8349.0 (2)	8622.0 (2)